NEW LAND ACQUISITION IN THE COLONIAL CHESAPEAKE, 1660-1706: A TEST OF THE MALTHUSIAN AND STAPLES HYPOTHESES

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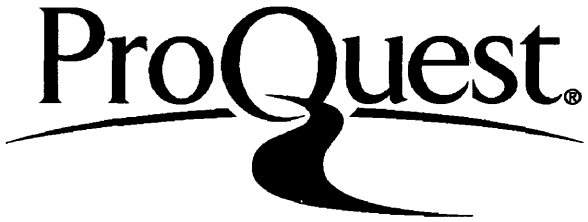

APPROVAL SHEET

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ABSTRACT

This study statistically tests the two dominant theories of early American economic growth and development--staples theory and Malthusian theory--in a study of new land acquisition in the colonial Chesapeake for the years 1660-1706.

The theories are examined first to discern the key elements of each, drawing upon comparative studies of the antebellum North and South and colonial New England. These key elements--population density for Malthusian theory and tobacco prices for staples theory--are then combined in one econometric model and subjected to a rigorous hypothesis test which ultimately rejects the staples model in favor of the Malthusian model of land acquisition.

However, additional analyses of population changes, immigration, and tobacco price fluctuations indicate that the relationship between economic and demographic variables in the colonial Chesapeake is complex and not at present sufficiently understood. In particular, the study identifies the need to further examine the effect of immigration and population pressure in early American economic and demographic development.

The study of new land acquisition also reveals that, in late seventeenth century Virginia, small patentees and large patentees responded to the same pushes and pulls. Planters, large and small, were more concerned with maintaining a steady income level than making quick profits. Most patentees did not use the patenting process to speculate in land, but rather accumulated land through a variety of methods. What land speculation and engrossment there was did not as a rule preclude general land availability.

A study of population density shows that the number of acres per tithable increased dramatically up to the 1670s, levelled off in the 1680s, and declined in the 1690s, but always maintained a level high enough to preclude any subsistence crisis.

All tests reject the notion that an economic transformation occurred in late seventeenth century Chesapeake, which puts into question syntheses of the colonial Chesapeake which revolve around such a transformation.

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INTRODUCTION

The social sciences have contributed much to the most recent developments in the historiography of early America. Whether called "social science history," "new social history," "new economic history," or "quantitative history," the more rigorous and demanding methodologies of the social sciences have opened up heretofore reticent historical sources and have begun to make sense of the massive amounts of historical data which have randomly survived from the colonial era. However, in contrast to the significant role of social science "methodology," social science "theory" has played a rather negligible role in this "new" history of the colonial era. Traditionally atheoretical, history for the most part continues to focus on the unique and particular of each historical period.

Nevertheless, colonial historians have adopted two theoretical approaches from the social sciences--the Malthusian (frontier) approach and the staples (export-led) approach--to help put in perspective the overall growth of colonial America. Each of these theories has various proponents, but neither approach has been able to claim total support. Demographic historians have tended to support the

Malthusian hypothesis and economic historians the staples hypothesis. There also exists a North-South split with New England historians favoring a Malthusian explanation and Chesapeake historians favoring a staples explanation.

Neither of these theories has been subjected to any rigorous test in the study of early America. "Almost all the work in the field now completed and most of that currently under way is descriptive, aimed at measurement and narration, at getting the facts right, rather than at econometric analysis" (McCusker 6). The purpose of this thesis will be to test these two models in an econometric analysis of land acquisition in the colonial Chesapeake.

Although social science theory could help colonial historians take maximum advantage of the historical data which already exists, most historians would argue that insufficient data survives from the colonial era to test social science theories. The cliometricians, who have contributed so much to testing our conclusions about other historical eras, have shied away from the colonial era with its paucity of numerical data. This paucity may have been true previously, but the tremendous explosion in data gathering in recent years has made this no longer the case. For the colonial Chesapeake, reasonably good annual data is available for tobacco prices, population, and patented land acreage. In any case, historians should not shrink from subjecting their theories to test for fear of incomplete data. Adopting the rigorous rules

of hypothesis testing from the social sciences, the historian simply should test the quality of the data at hand rather than bemoan the absence of perfect data.

A good way to test any social science theory is to develop, from the general theoretical model, a specific mathematical model which can be tested using standard statistical tools. For the colonial era, we could develop two models representing the two theoretical approaches and put each to the test and see which gives better statistical results. However, although colonial historians may believe one of the two models offers a better explanation, all recognize that economic and demographic forces are not unrelated. The two models are, in reality, just ways of simplifying historical processes which are due to many varied forces: economic, demographic, military, political, ideological, socio-cultural, biological, etc.

Since most historians recognize that both demographic and economic forces are always at work in society, the true theoretical model should incorporate both forces. The two theories thus can best be tested within the context of one model. Statistical tests may show that one set of forces is more significant in certain situations, thus tending to support one theory over the other. But we should be careful to not let the data dictate the model. The analysis of land acquisition in the colonial Chesapeake can be only one test of the two theories. Much work will remain to be done before

we will have an accurate theoretical model of early American development. The results of this analysis will at least help to reveal something of the complex interrelationship between economic and demographic forces.

CHAPTER I

THEORETICAL BACKGROUND

In The Economy of British America, 1607-1789, McCusker and Menard discuss the two traditional approaches to explaining the growth and development of colonial America:

> The Malthusian, or frontier, approach locates the central dynamic of early American history in internal demographic processes that account for the principal characteristics of the colonial economy: the rapid, extensive growth of population, of settled area, and of aggregate output combined with an absence of major structural change. The second tradition, usually described as the staples approach or, more generally, as an export-led, or "vent for surplus," growth model, attaches fundamental importance to the export of primary, resource-intensive products. It argues that the export sector played a leading role in the economy of British America and maintains that the specific character of those exports shaped the process of colonial development. (18)

As McCusker and Menard admit, "both approaches are essential to understanding the colonial economy, and often it is in the

relationships between population growth and external demand that answers to the most interesting questions will be found" (19).

Land and population play a central role in both theories, although each looks at land and population differently. The Malthusian approach focuses on population pressure on the land. The staples approach focuses on land and population as the two key factors of production. In order to develop an overall theoretical model for land acquistion, we need to examine more closely the factors which affect demand for land according to the two theories.

Staples Approach

Although the staples approach has influenced much of the work on the colonial Chesapeake, we can benefit more from a comparative analysis of the excellent, staples-influenced research done on the cotton economy of the antebellum South. Spurred on by the seminal work of Douglass North, "new economic historians" such as Peter Temin, Gavin Wright, Peter Passell, and Stanley Lebergott have added greatly to our understanding of the antebellum South. This work readily provides an excellent framework for developing a "staples" explanation of land acquisition in the colonial Chesapeake.

It is unfortunate that the "new social historians" of the colonial Chesapeake have paid so little attention to the

"new economic history" of the antebellum South for the two economies shared many striking features. Douglass C. North emphasizes the importance of cotton in the U.S. economy of the antebellum era. "Cotton was strategic because it was the major independent variable in the interdependent structure of internal and international trade" (67). A similar claim can be made for tobacco in the colonial Chesapeake. In both, land was abundant and labor was scarce, with capital and technology playing relatively minor roles. Both were dominated by farms basically self-sufficient in foodstuffs which produced essentially one market commodity--tobacco or cotton. This staples environment favored the growth of large plantations employing unfree labor--slaves and indentured servants in the colonial Chesapeake and slaves in the antebellum South. The regional economies were rocked by the vagaries of the dominant European economy.

A general examination of land acquisition and settlement patterns on a local, regional, or national basis reveals similar patterns for both the colonial Chesapeake and the antebellum South. North's statement that "plantations extended up navigable waterways, and as the land closest to water transport was taken up, plantations developed farther from these transport arteries" (64) could just as easily have been made about tobacco as about cotton plantations. Rivers provided the major means of transportation and cities were few and far between. The Southern frontier was always the fastest

growing region of the South, both in population and land acquisition. The southern farmer was Virginia's posterity, each succeeding generation pushing further and further to the south and west.

Douglass C. North placed land acquisition at the heart of the cotton economy. "The secular decline in the price of cotton between 1818 and 1845 reflected the fact that, despite the enormous growth in demand..., the supply of cotton grew even more rapidly. This was primarily a result of the expanded acreage (although yields were much higher in the Southwest) that came about with the great migration into western lands between 1815 and 1839" (123-125). Cotton "booms" were precipitated by the exhaustion of available land capacity which led to higher cotton prices. "During each period of expansion, millions of acres of new land were purchased from the government for cotton production. Once this land had been cleared and a crop or two of corn planted to prepare the soil, the amount of cotton available could be substantially increased" (71).

Peter Temin contested North's assumptions that changes in cotton production could be directly linked to new land sales. Temin instead believed that "cotton-growing capacity was determined by the quantity of labor, not the quantity of land" (468). "If we assume that there was an upper bound to the amount of land a given number of workers could farm efficiently, then the speed at which new land could be settled

would depend on the growth of the potential labor force, i.e., the Southern population" (468). Overall, Temin found that the production of cotton was fairly insensitive to cotton prices.

Gavin Wright examined Temin's contentions and showed that cumulative land sales and a time trend (to reflect population growth) explained changes in cotton production better than population growth alone (115). Population growth alone did not necessarily lead to expansion; also required was a willingness to migrate to new lands. "Cumulative land sales serve as an approximate index of the number of such migration-decisions which have been made,...as a reflection of the extent to which expansion occurred" (112). Overall, though, Wright found that "Temin's description of the course of events is more correct than North's" (116-7) and that there is no evidence of "a periodic 'exhaustion of capacity' as an identifiable phenomenon in Southern development" (117).

Although there is disagreement as to the effect of land acquisition on staple production, for North, Temin, and Wright (and all followers of the staples model), there is no disagreement that staples price determined demand for land. "While there had been little incentive to buy and clear new land for cotton during the period of low prices, rising prices triggered a land boom in the South" (North 73). Whether cotton capacity was exhausted or British demand increased, the subsequent higher cotton prices would have led to greater demand for land (Temin 466). Wright found that "a distributed

lag function, with weights assigned to past cotton prices declining geometrically with time" provided the best explanation of land sales (112,116).

Gavin Wright states well the staples model's position on land acquisition: "it was not the physical supply of labor which influenced decisions on settling land, but the expected returns" (112). Likewise, "the price of land was not the major obstacle to migration; the question facing a potential migrant was whether the returns from farming the new land were likely to be great enough to compensate for the expense of migration, settlement, purchase of equipment and bringing land into cultivation" (112). Thus the staples model determines that land acquisition will be mostly a function of staples price, the prime determinant of expected returns in staples theory.

The demographic forces associated with Malthusian theory are not usually considered in "staples" analysis of land acquisition. Gavin Wright, in his study of annual land sales in the cotton South does include "a time trend to reflect the secular rate of migration" (112). Unfortunately he does not report the significance of the time trend coefficient in his final model, although he indicates that including the time trend improves all of his price elasticities. (112,116). Stanley Lebergott has done the most sophisticated economic analysis of land sales in the antebellum South. Lebergott's model "presumes two basic determinants of the demand for

land--the expected money return and the effective supply price. The expected monetary return is a function of the expected income from land, the riskless rate of return, expected capital gains from land, and the variability of expected income. The supply price of land is a function of the supply price of federal land (encompassing the explicit and implicit prices and the terms of sale), the Graduation Act of 1854, and the quality of land, in particular the role of Indian cessions" (197). In this most thorough economic study, Lebergott totally ignores demographic forces.

Although the work on the antebellum South provides much guidance for developing a specific staples model of land acquisition in the colonial Chesapeake, such a model will rest upon a great body of previous staples-influenced research into various aspects of the economy of the colonial Chesapeake. As McCusker and Menard state, "booms and busts in the tobacco trade have been the subject of intense study, particularly in the early colonial period. These studies provide powerful evidence that the Chesapeake economy was export led, for the fluctuating fortunes of the tobacco industry reverberated throughout the entire economy and affected the pace of immigration, the advance of settlement, the extent of opportunity, government policy, experiments with other staple exports, the spread of manufacturing, and the level of material well-being in the colonies" (125). Probably the most "testable" explanation of the staples model for the colonial

Chesapeake can be found in Paul G. Clemens's The Atlantic Economy and Colonial Maryland's Eastern Shore:

> Boom and bust characterized the economic lives of Chesapeake tobacco planters. These cycles of prosperity and recession depended on the relationship among immigration, the price of tobacco, the production of the staple, and the consumption of the crop in England. Booms began with an upswing in the price of tobacco...Generally, production increases followed soon after a rise in the price of tobacco, as English merchants, encouraged by favorable market conditions, shipped large numbers of laborers to Maryland and Virginia. Because tobacco cultivation required little land, planters quickly cleared new fields and set immigrant laborers to work (30).

Clemens's model indicates clearly a strong positive relationship between tobacco prices and immigration, new land acquisition, and tobacco production.

As straight forward as this interpretation of the tobacco economy is, staples enthusiasts are often contradictory about planter behavior. Clemens notes that "the price of tobacco remained strong enough to drive up the level of production," but, in the same paragraph argues, "as prices continued to fall, the pressure to increase farm production and maintain profit levels intensified" (35). Menard also recognizes this

contradiction between the staples thesis and actual planter behavior:

> Indentured servants were a short-term investment; returns had to be realized within a few years of purhase if they were to be realized at all. During periods of high tobacco prices, planters may have tried to boost production by purchasing servants in hope of making quick profits; when tobacco prices were low planters perhaps avoided investments that demanded immediate returns. This is an attractive argument, but it does not fit the available evidence. Prices for indentured servants were not consistently higher in boom times than in depressions. Small planters, furthermore, had fixed expenses and debts to pay; when tobacco prices declined they felt pressures to expand production in order to maintain the income of their farms. (1975,349-351)

According to both Menard and Clemens, only the English tobacco merchants were efficient capitalists and only the merchant-controlled supply of servants and credit saved the colonial Chesapeake from economic disaster. Contrary to staples theory, planters left to themselves would have continued to expand production through good times and bad.

But this analysis of planter behavior is not new. Lewis C. Gray said the same in his seminal analysis of Agriculture

in the Southern United States to 1860:

> While producers' prices were subject to great fluctuations, the production of tobacco was essentially inelastic. This was partly due to the fact that it was the sole money crop...Practically the only alternative of the planters, therefore, was to resort to a greater degree of self-sufficiency. Inelasticity of production was partly due also to the characteristic inability of farmers to control production because of seasonal fluctuations. A considerable part of the crop, moreover, was produced by backwoods farmers, employing largely their own labor and producing with little reference to conditions of prices and costs...Returns from tobacco were employed to meet charges on account of capital, usually of indebtedness, or to satisfy wants of planters. Consequently it was observed that low prices, far from inducing voluntary limitation of production, actually operated for a time to spur planters, especially those deeply in debt, to extra efforts to enlarge their product. (276)

Overall, "proof" of the staples model for the colonial Chesapeake rests on rather meager evidence. Much of the analysis has been restricted to descriptive graphs and tables with no rigorous statistical analysis. Some historians have

noted the strong correlation between changes in taxable population and tobacco prices (Clemens 53). Others have noted the correlation between unindentured servant registration and tobacco prices (Menard,1973,326-8; 1977,363-5; 1988, 115-117; Walsh,197,26-27). Others have even noted a strong correlation between premarital sex and tobacco prices (Gladwin 63-65). However, no rigorous statistical test has yet proved the staples model works in the colonial Chesapeake.

On the other hand, there is at least one rigorous statistical test which tends to cast doubt on the staples thesis. Charles Wetherell is one of the few scholars who have criticized the general acceptance of the staples model for the colonial Chesapeake. Using a Box-Jenkins time series approach, Wetherell found only a very weak, if any, relationship between English tobacco imports and farm tobacco prices (1984,203). Wetherell argues that "customary behavior among some planters (cultivate as much tobacco as possible because the opportunity exists) could account for any volume of production as easily as instrumental behavior among other planters (buy more land and labor to plant more tobacco because the price is rising)" (1984,209).

Wetherell uses English import data as the best data extant to test the staples thesis and he is justified in using the production data for a test since the staples promoters have so often quoted the import data in their behalf (e.g., Clemens 35). However, I do not believe these English import

data (basically Port of London data) serve as a good proxy for Chesapeake tobacco production. Intuitively, I would expect that Chesapeake tobacco production would have showed much greater variation than that indicated by the English import data. As Wetherell himself states, the "arguably important Scottish trade" is ignored. It is possible the London market was a relatively fixed demand market and all other production was diverted to other British or even other European ports.

Wetherell sees the central focus of the staples thesis in the relationship between price and production. "[I]ncreases in European demand pushed up prices, which led in turn to increased investment in land and labor, and eventually to greater production" (201). As he states, "these arguments are all potentially verifiable. The quantitative relationship between tobacco prices, land sales, immigration, and perhaps even slave purchases could be examined if the relevant data were available" (201). Although a test of the relationship between price and production may be the only "true" test of the staples model, the lack of any good proxy for production makes such a test, at present, impossible. However, this does not mean that the staples model can not be tested; reasonably good data exists for both land and population. Considering the necessary intermediate link between price and production, a test of the relationship between price and land acquisition will serve adequately. Such a test is the purpose of this study.

Malthusian Approach

In contrast to even this rather haphazard testing of the staples thesis by economic historians, as McCusker and Menard note, "the Malthusian model is largely untested" (33). Historians who have worked with New England data, stressing the importance of demographic factors in the development of early America, have done the brunt of the work. Daniel Scott Smith, Edward M. Cook, Jr., Kenneth A. Lockridge, Philip J. Greven, Jr., and Darrett B. Rutman have explored many of the interrelationships between population size, density, growth and wealth inequality.

Of these New England studies, Rutman's examination of the peopling of New Hampshire towns provides the most explicit model for testing the Malthusian approach. Rutman intertwines demographic, economic, and socio-cultural forces in a model which tries to capture the "systematic link between the level of economic opportunity and migration" in Anglo-America (1975,273-4). Rutman hypothesizes a homeostatic governor, "continually reading the atmosphere of the system, specifically the population density, and testing density against an optimum established by the level of economic opportunity. When the governor senses that density is below optimum, it triggers in-migration much as a thermostat sensing a temperature below its setting triggers a heating device;

when the governor senses density above the optimum, it calls for out-migration" (1975,275). Rutman recognizes that socio-cultural attitudes towards mobility affect this "optimum density."

Rutman's focus on the effect of the "level of economic opportunity" on optimum density stresses the importance of the move to "economic opportunities other than agricultural." As long as the economy remained basically agricultural, the "optimum density" should remain constant unless attitudes toward mobility change. Rutman finds that "optimum density" was independent of soil type or topography, implying that agricultural efficiency also had little effect, although he admits that his determination of optimum density was based on towns located in the southeastern part of New Hampshire where land "waste" was minimal (1975,291).

Richard A. Easterlin, studying demographic changes in the antebellum North, troubled by the "lack of a plausible explanation of the mechanisms by which these variables ['land availability' or farm population density] exert their effect" (71), proposes a mechanism which links migration, fertility, and population density through farm acreage values. Easterlin's model, stimulated by Greven's work on colonial Andover as well as the work of Yasuba, Forster, and Tucker on the prime effect of population density on fertility, "centers on farmers' concern for giving their children a start in life" and the intricate inverse relationship between acreage values

and return on farmers' capital (71).

> Cheap acreage induces in-migration and encourages high fertility among new settlers...This, in turn, leads to a rapid rise in population density, driving up farm acreage values. The rise in acreage values, however, reacts adversely upon the rate of population growth, slowing it down, by lowering both net migration and fertility. As the rate of population growth and increase in density slow down, the rise in farm values moderates, thereby slowing down the declines in fertility, migration, and population change. This goes on, back and forth, until total population, fertility, net migration, and farm acreage values stabilize at a level commensurate with the area's potential. (72)

Easterlin finds that such a model explains "closely linked patterns of economic and demographic change that have reoccurred in state after state," North and South (72-73).

Chesapeake historians have attempted to derive independent estimates of an "optimum density." Most of the work has focused on the minimum amount of land needed to both keep a laborer busy year-round and, at the same time, maintain soil quality. In what has been called the "Chesapeake system of husbandry," a planter cleared some land, planted tobacco for a few years until the soil was depleted and then allowed the tobacco land to return to forest until the soil became fertile

again (at which point it could be cleared and replanted in tobacco). At any point, particularly on older farms, a planter could have as much as four-fifths of his land in some stage of reforestation. Since one laborer could work only about 3-4 acres a year and could plant a tobacco crop about 3 years in a row on the same soil before depletion, and since it took about 20 years for reforestation, each laborer required at least 20 acres (Earle 29). However, since not all land was arable and with extra requirements for wood, pasturage, and foodstuffs, "'50 acres of land for every working hand'" was considered the norm among 18th century planters (Kulikoff,1986,48; Earle 210).

Does the Malthusian model imply that a crisis is eventually reached, as Lockridge believes happened in 18th century Massachusetts (1971,468-482)? Not if a "governor" as described by Rutman and Easterlin existed. If pockets of over-crowding existed, it was because atttitudes towards mobility were highly negative. As long as attitudes toward mobility were flexible, such a crisis need not have been reached for there truly was an abundance of land and few barriers to new land acquisition in both the colonial or antebellum era. Malthus himself understood the uniqueness of America, where the means of subsistence could grow geometrically with the population (Smith,1980,15).

However, Lorena Walsh has shown that socio-cultural attitudes towards mobility may have changed as the Chesapeake

society matured. "Once natives [Anglo-Americans] became a majority among adult men in the community, outmigration slowed...Family ties became increasingly important and appear to have outweighed economic considerations when a creole man debated whether to stay or leave" (Walsh,1987, 98). For Charles County, Maryland, such a transition had occurred by 1705. Such a transition likely occurred in many other mature counties. According to the Malthusian hypothesis, this change in attitudes would have raised the optimum density (population per square mile) and lowered the demand for new land over time.

So stated, Malthusian theory is quite at odds with staples theory. Staples price fluctuations do not represent true changes in the "level of economic opportunity" and, thus, do not affect "optimum density." For the study of land acquisition, as long as attitudes towards mobility did not change and the economy remained agricultural, land demand was only a function of population density.

Transformation Synthesis

The best attempt to synthesize the recent work on the colonial Chesapeake is Allan Kulikoff's Tobacco and Slaves. Concentrating mostly on the 18th century Chesapeake, Kulikoff takes advantage of the staples-influenced work of the 17th century to demonstrate a transition from dominant economic to

dominant demographic forces around the end of the 17th century.

> Both population growth and the rise of tobacco production rested upon the creation of new plantation households, a process increasingly tied to the availability of land. During most of the seventeenth century, the price of tobacco and English economic conditions determined the rate of household formation...The increase in the percentage of native white adults at the end of the seventeenth century reduced the direct impact of the tobacco trade and increased the significance of land availability for household formation" (1986,45).

For the greater part of the 18th century, Kulikoff believes that the colonial Chesapeake fit the Malthusian model.

Kulikoff is trying to synthesize the staples-directed work of Chesapeake scholars with the Malthusian-directed work of the New England scholars to show that once a native white population established itself, demographic factors became dominant. In Kulikoff's staples view of the 17th century Chesapeake, demographic factors did not dominate because most immigrants could not afford to pay their passage and so came on the demand of Chesapeake planters who were driven by the desire for tobacco profits. High tobacco prices led to greater demand for indentured servants and slaves and thus increases in population. Demographic factors like fertility

and mortality, which dominated the 18th century Chesapeake population growth, were independent of the tobacco economy.

Kulikoff's Chesapeake transition is basically the same as Clemens's Eastern Shore "transformation":

> While through the 1680s economic life had revolved around immigrant male planters who had a penchant for buying and selling labor and land as the market dictated, by the first decade of the new century the economy centered on native-born families who had settled into the routine of making a living from plantations inherited from an earlier generation of colonists...As land filled up, opportunity contracted, immigration shifted elsewhere, the poor left, and second- and third-generation landowners took over. Such a process--settlement, crowding, and out-migration-occurred in virtually every English colony. The rate of the process depended primarily on the population the land could support, which in turn reflected the relationship (or lack of it) of local agriculture to the market (77).

What Clemens identifies as a local transformation at the turn of the century, Kulikoff extrapolates to the whole Chesapeake at the same time period.

However, Kulikoff does not really test either model. Most of his analysis is of a general descriptive nature. Although Kulikoff relies heavily on the concept of "optimum

density," there is no statistical test of his assumption of "'50 acres of land for every working hand'" as optimal. Indeed, his graph of acres per taxable person would seem to indicate that Virginians continued to far exceed that optimum density throughout the 18th century (1986,49). Although Kulikoff provides an interesting synthesis of the two models, he does not really test economic against demographic forces in either the 17th or 18th century. He does not show the interrelationship between the two forces. It was either one or the other.

Higher tobacco prices could just as easily have caused people to move to the frontier in the 18th century as in the 17th century. Population density could have worked as the controlling mechanism in both centuries. Kulikoff's tacit acceptance of the staples model in the 17th century rests on the untested assumption that immigrants came to the Chesapeake when "times were good in the Chesapeake," although he also admits they might have come over because conditions were "depressed in England" (1986,45). Clearly whether immigrants came to the Chesapeake in "good" or "bad" times is a critical test of the staples model, but another test which has yet to be done.

The Clemens/Kulikoff synthesis model fails most dramatically to explain migration in the colonial Chesapeake. In comparison with Rutman and Easterlin's single set of factors to explain both in-migration and out-migration, the Clemens/

Kulikoff model uses one set of factors to explain in-migration and another set to explain out-migration. (People immigrated because tobacco prices were high but emigrated because tobacco prices were low.) Kulikoff posits that 17th century out-migration was unique because "optimum density" had not been reached anywhere in the 17th century with additional tidewater land so readily available. But just how different was the motivation of the farmer settling on the 17th century tidewater frontier compared to the farmer settling on the 18th century piedmont frontier or the 19th century southwest frontier? Were immigrants, European or American, so much different from emigrants? Did this behavioral transformation occur simultaneously throughout the Chesapeake, equally in new frontier and older settled counties? Clearly, we need to know much more about the overall process of migration, both in-migration and out-migration, before the economic and demographic history of the colonial Chesapeake can be synthesized.

Anita H. Rutman, without resorting to either the Malthusian or staples models, believes there was much more regularity in migration decisions. Each new area went through similar changes in its transformation from a frontier region to a settled community, but there was no simultaneous change throughout the Chesapeake. Opportunity was great for first arrivals. "The wealthiest brought property accumulated elsewhere in with them, yet both those who entered with little and those who entered with much tended to prosper as land values

rose by virtue of settlement, and later arrivals provided ready markets for excess cattle and food crops. On an individual level, however, fortunes varied" (15). Those who were less successful "either left to try elsewhere or, particularly after the turn to slavery, increasingly settled for relative, but consumer-oriented, poverty" (15).

Although the advent of slavery modified this local process somewhat, the process remained basically the same in Rutman's Middlesex County, Kulikoff's Prince George's County, Clemens's Eastern Shore, Beeman's Lunenburg County and elsewhere in the colonial Chesapeake. Indeed, as noted by Carr et al (1988,34), the process is the same as that identified by Wilbur J. Cash as the central theme of the Old South. "For the history of the South throughout a very great part of the period from the opening of the nineteenth century to the Civil War (in the South beyond the Mississippi until long after that war) is mainly the history of the roll of frontier upon frontier--and on to the frontier beyond" (Cash 4). This is a much more appealing hypothesis than Kulikoff's transformation theory.

There is nothing in Anita Rutman's argument which is contrary to either the staples or Malthusian model. Opportunity could be defined in terms of the tobacco market or optimum density. "Push" or "pull" factors could be dominant. However, Rutman's argument runs counter to attempts to synthesize the colonial Chesapeake by saying the 17th century was staples

and the 18th century Malthusian. No such transformation for the entire Chesapeake can be supported by the available data. What is required is a more complex model entailing both economic and demographic factors which explains why the two centuries were so similar, not two separate models which explain why they were so different.

For the study of land acquisition in the colonial Chesapeake, the two models have very different implications. The staples model hypothesizes that land acquisition is a function of opportunity in the tobacco economy (tobacco prices, labor productivity, transportation changes, price of land, etc.). The Malthusian model hypothesizes that land acquisition is a function of population density. Expressed either as a normal density (persons per square mile) or inverse density (acres per person), the Malthusian approach predicts increased population pressure on land drives people to move to less dense areas where land can be more easily obtained. The staples model predicts that people acquire land when staple prices rise. Whereas the staples model states that economic forces precede demographic forces (higher tobacco prices leads to increased immigration to and reduced emigration from the Chesapeake), the Malthusian model states that these economic forces have a mere coincidental relationship. The staples model focuses on "pull" factors and the Malthusian model focuses on "push" factors.

As McCusker and Menard state, the implications of the

two models are testable. However, rarely, if ever, are demographic and economic forces given equal status in any objective test. Economic historians tend to lump demographic forces into a time trend and demographic historians tend to ignore short-term economic effects. The "true" model must include both economic and demographic factors because both influence every aspect of the economy. Only when tested within a combined model will historians be able to determine which model, staples or Malthusian, better explains early American development.

Tests of such a model may show that economic forces were more significant in one region (e.g., the West Indies) and demographic forces more significant in another region (e.g., New England). Or such tests may show that one set of forces tended to prevail across all regions and time periods. Or perhaps they will prove, as Daniel Scott Smith claims, that "if staples provided the engine of change, demography acted as the governor of the system" (1982,281). Identification of the relationship between economic and demographic forces may not be so simple as identifying one as the engine and the other as the governor. More likely, both economic and demographic forces were the engine of change and the governor lay in the complex interrelationship between the two forces.

CHAPTER II

NEW LAND ACQUISITION IN THE COLONIAL CHESAPEAKE

To develop a model of new land acquisition in the colonial Chesapeake, we need to examine the various theory-derived factors which might affect demand for land and to determine what data might be available to measure each factor. But before examining these "independent" variables, we first should examine the "dependent variable"--new land acquisition--in its historical context.

Land Patents and "New" Land Acquisition

How was land acquired in the colonial Chesapeake? According to the Browns, who equated economic democracy in Virginia with the availability of cheap land, the "common man" could "buy land from one of the land speculators or land jobbers who had received a large grant from the King, and of course he could buy land from others who had acquired it by whatever means. In addition, he could inherit or receive land as a gift, marry someone who owned land, or lease land for a term of years or on a life lease" (11). Or else, for the

payment of certain fees (including the purchase of necessary headrights or treasury rights), he could get a patent to land. "Men who could not pay the small amount necessary to acquire land, or preferred to buy a slave as some did, could always lease land in Virginia" (Brown 23). For the study of "new" land acquisition (land not previously owned) in the colonial Chesapeake, we are primarily interested in the colonial land patents.

Analyses of land acquisition have been relatively neglected in the colonial Chesapeake compared to the antebellum South and even to colonial New England. As Kenneth Lockridge has stated, "land and time must be the touchstones of any enquiry into the social evolution of early America: land because the economy was overwhelmingly agricultural and because land has been both the symbol and the essence of American opportunity; time because there was so much of it" (1971,468). Greven's study of Andover revolved around the interrelationships between population, land, and the family. Douglass C. North, Peter Temin, Gavin Wright, Peter Passell, and Stanley Lebergott have all added to the understanding of land acquisiton in the antebellum South. Land acquisition studies in the colonial Chesapeake have been restricted to Kulikoff's look at taxable acreage totals in the 18th century and as part of several local studies by Kevin Kelly, Carville Earle, Michael Nicholls, Ransom True, Paul Clemens, and Lorena Walsh among others.

The absence of any overall analysis of new land acquisition in the colonial Chesapeake is even more marked because excellent, fairly complete sets of land patent records exist for all of the colonies usually included as part of colonial Chesapeake studies: Virginia, Maryland, and North Carolina. For the purpose of this study, we will focus on only one Chesapeake colony: Virginia.

All of the great Virginia historians from Bruce and Wertenbaker to Craven and Morgan have recognized the importance of the Virginia land patents, which Harrison called "Virginia's most precious surviving muniment of her past" (7). Indeed, with the destruction of many colonial and county records by the ravages of both time and war, the Virginia land patents are "the only [record] that has any claim at all to comprehensive coverage" (Craven,1971,9). The task has been made relatively easy with the publication of an excellent series of abstracts Cavaliers and Pioneers by Nell Marion Nugent, Custodian of the Virginia Land Archives from 1925 to 1958. The first volume was published in 1934 (covering Patents Book Nos. 1-5 [1623-1666]), but unfortunately her abstracts of Book Nos. 6-8 (1666-1695) were not published until 1977, followed by Book Nos. 9-14 (1695-1732) in 1979.

This greatest source of information on colonial Virginia has been severely underutilized. Major studies focusing on the land patents have been restricted to determination of the average size of land patents from 1626-1700 (Bruce 1:527-532),

the social mobility of indentured servants (Wertenbaker 74-81; Voorhis 70), and the annual number of headrights as an index of immigration (Wertenbaker 35-36; Craven,1971,14-16; Morgan,1973,363-5). Most of these studies have relied heavily on random sampling because of the vast amount of information contained in the land patents. However, these attempts have barely begun to tap the wealth contained in the Virginia land patents.

In order to correct this neglect and to determine land acquisition patterns in the colonial Chesapeake, a computer data base of the information contained in Nugent's abstracts was created covering all the patents from 1660-1706. This data base includes all names, dates, locations (county, river, creek, parish, etc.), and relationships (neighbor, previous owner, headright, etc.). A breakdown of how the land came into the ownership of the patentee (new land, lapsed land, escheated land, inherited land, land previously patented by another, patent renewal, etc.) allows more precise estimates of land acquisition.

The land patent system used throughout the colonial period was basically a continuation of the practices initiated under the Virginia Company. By the Second Charter (1609), the Company was appointed and allowed "'under their common seal [to] distribute, convey, assign...such particular portions of lands...unto such our loving subjects" (Harrison 12). Actual distribution of land began after 1616. The headright was

almost exclusively the grounds on which land patents were awarded during the seventeenth century. Although there were many variations (well described by Voorhis [19-21]), the basic headright guaranteed that a grant of fifty acres be made for every person immigrating to the colony, the grant being "'made respectively to such persons and their heirs at whose charges the said persons going to inhabit in Virginia shall be transported'" (Harrison 16-17). Although in temporary confusion with the demise of the Company in 1624, land policy continued essentially unchanged under the Crown until the introduction in 1699 of the treasury right, which allowed a person to acquire a patent by payment of a fixed fee. Basically anyone could take up a patent for new land at any time as long as there was no legal objection.

According to Beverley, a patent for new land was acquired thus:

> First, the Man proves his Rights; that is, he makes Oath in [County] Court, of the Importation of so many Persons, with a List of their Names. This List is then certified by the Clerk of that Court, to the Clerk of the Secretaries Office; who examines into the Validity of them, and files them in that Office, attesting them to be regular. When the Rights are thus certified, they are produced to the Surveyor of the County, and the Land is shewed to him; who thereupon is bound by his Oath to make the Survey,

> if the Land had been not Patented before....This Survey being made, a Copy thereof is carried with the Certificate of Rights to the Secretaries Office, and there (if there be no Objection) a Patent must of course be made out upon it, which is presented to the Governor and Council to pass. (277-8)

What we call today the "Virginia Land Patents" are 42 volumes (in 10 books) of "recorded copies of patents for land issued by the English crown between 1623-1706 and 1710-1774," preserved in the Virginia State Library in Richmond (Gentry 3). The original patents were hung as loose leaves on strings in the 17th century (Nugent 1:226, 394) but by 1683 the process of transcription had begun (Nugent 1:152). The essential question for the historian is what percentage of the original patents were eventually recorded in the bound patent books? Contemporary sources offer a fairly gloomy picture. The earliest evidence comes in the October 1666 "Act for conformation of titles" passed by the Assembly. Finding "many pattents for great parcells of land, for which there appeare not any right upon record," the act traces the problem to the "defects of the clerks of those times in not makeing present entry of the rights delivered to them, and the casualty of two severall fires whereby many of those rights with other papers were destroyed" (Hening 2:245). Robert Beverley, who transcribed Patent Books 2 & 3, describes the general shambles of the Secretaries Office in the years following Bacon's Rebel-

lion, along with the devastation of the Jamestown fire of October 1698 (102-103). Hartwell, Blair, and Chilton noted in 1697 that "there are many Patents and other Records, in that Office, in loose torn pieces, that are scarcely legible, and if some speedy Care not be taken, they will become of no Use" (49). However, most modern historians from Bruce to Wertenbaker to Craven have placed much confidence in the preservation of the original record (Bruce 1:528-9; Wertenbaker 34; Craven 12,33).

One historian who has questioned the completeness of the land patent record is Edmund Morgan. In a comparative analysis of county records with land patents (as abstracted by Nugent), he found that "most of the patents that appear in [county] deeds appear also in the patent books, but a good number do not...And even in the patent books themselves there is evidence of omissions. It was common for a man who purchased land from another man to obtain a new patent in his own name, often with additional acreage granted for persons imported. The date of the first patent and the name of the person who obtained it were recited in the second. But the original record of the first patent is often not to be found in the patent books" (365).

Morgan's method for determining the completeness of the patent record from the patents themselves is certainly testable using the patent data base. A computer search for matched patents, by name (using a coding system to account

for variant spellings described in Appendix I) and exact date, yielded an overall correlation of 48.5% for the years 1664-1706. However, a rigorous combined manual and computer search for the non-matched patents revealed a correlation of 86.2%. Sometimes the date was off by a day or a year, sometimes the name was spelled just enough different that the coding system failed to match, but the county, location, acreage were all identical. These problems are all due, no doubt, to the many times the names and dates have been transcribed from the original patent to the patent books to Nugent's abstracts. Undoubtedly, slight errors have been introduced with each transcription.

A breakdown of annual survivability correlations for the years 1660-1706 shows a wide range, indicating certain years suffered greater loss of records. In particular, the years 1660-1662 show a very high loss because very few of the original patents can be traced in this time period. For the succeeding years 1663-1666, the correlation improves each year but are still well below the average. Undoubtedly these low correlations verify the problems identified in the October 1666 "Act for conformation of titles" mentioned above. This is also confirmed by the great number of renewals of patents in the late 1660s for land originally patented during the early 1660s.

For the years 1667-1687 the record is remarkably complete with a correlation of 94.4%. Interestingly the correlation

drops for the years 1688-1706 to 70.7%, possibly indicating problems pointed out by Beverley and Hartwell, Blair, and Chilton, but it also could be random error due to the exceedingly small number of references to patents in this time period. I have no doubt the actual correlations would be much higher if I had the tools for taking into account every possible transcription error. From this analysis, I believe the patent record for the years 1664-1706 is complete enough to present no problem for the study of land acquisition patterns in late 17th century Virginia.

One inherent problem with the land patents for any study of the "colony" of Virginia are the land grants in the Northern Neck, the great peninsula between the Potomac River and Rappahannock River, whose history differed significantly from the rest of the colony. Originally granted in 1649 to "Lord Ralph Horton, Lord Henry Jermyn, Lord John Culpeper, Sir John Berkeley, Sir William Morton, Sir Dudley Wyatt, and Thomas Culpeper, Esq. by Charles, the exiled son of executed Charles I, for their support. Lord Thomas Culpeper, son of one of the original patentees, by 1681 had purchased the rights of the other patentees and become sole proprietor of the Northern Neck" (Gray ix). Actually land in the Northern Neck continued to show up in the Virginia land patents through 1679 and proprietary land grants in the Northern Neck did not start until 1690. Only the first volume (1690-1692) of the Northern Neck land grants was transcribed by Nugent; Gertrude

Gray completed transcriptions of the later Northern Neck land grants. The present data base does not include data from either of these abstracts.

The basic problem is whether to include grants in the Northern Neck in a study of land acquisition in colonial Virginia. The 1660s, when the Northern Neck was part of the colonial land patent system, was a period of rapid land acquisition in the Northern Neck. Undoubtedly, land available in the Northern Neck swayed decisions to claim land in the 1660s. Similarly, the uncertainties of land title in the Northern Neck in the late 17th century undoubtedly swayed potential patentees to the south. The Northern Neck patent system for the period under study was in considerable flux; the office was closed during the years 1700-1703 (Gray 27) and probably at other times. The best alternative is to present three analyses: (1) all new land in the Virginia (Nugent) patents "as is", including patents in the Northern Neck before 1679; (2) only new land patents south of the Rappahannock River; and (3) all new land in the Virginia (Nugent) patents and Northern Neck (Nugent and Gray) patents through 1706. Northern Neck patent analysis was restricted to simply tabulating annual totals of new land patent acreage from the Nugent and Gray Northern Neck abstracts. In the regular Virginia patents, there is generally little problem identifying whether the patent is for land above or below the Rappahannock since the county is usually listed as part of the

patent. However, a problem does exist for Lancaster County through 1669 and "Old" Rappahannock County through 1692 since these counties covered land on both sides of the Rappahannock. Fortunately, enough information is usually contained in the patents to identify the patent as either north or south of the Rappahannock River. Table I presents the three different patent acreage series.

Land Acquisition vs Land Speculation and Engrossment

Why did people acquire land? Although the staples and Malthusian models explain the overall growth and development of early America, individuals made decisions to acquire land. As seen by McCusker and Menard, the Malthusian and staples approaches have individual counterparts called the "subsistence model" and the "market model." The "subsistence model" claims that "farmers were not much concerned with profit, that their principal interests were subsistence and the long-term security of the farm, that they did not try to maximize production of cash crops and marketed only their surplus, that they avoided risk and were suspicious of innovations." In the "market model," "farmers were latent entrepeneurs, willing to take risks and accept innovation, who found their drive for profits frustrated by high factor prices, primitive technologies, poor transportation networks, and weak markets" (McCusker 298). These models hypothesize very different

TABLE I

ANNUAL VIRGINIA NEW LAND PATENT ACREAGE

Year	Virginia Patent Acres	Rappahannock South Patent Acres	Virginia and Northern Neck Patent Acres
1664	146392	94640	146392
1665	93244	70156	93244
1666	135923	94160	135923
1667	105290	74891	105290
1668	64526	41683	64526
1669	82194	50943	82194
1670	82079	51051	82079
1671	48177	44695	48177
1672	91257	79543	91257
1673	106468	104455	106498
1674	104250	89160	104520
1675	34709	34013	34709
1676	28391	28391	28391
1677	24835	2048	24835
1678	49320	22733	49320
1679	23260	15860	23260
1680	33420	33420	33420
1681	38239	38239	38329
1682	69299	69299	69299
1683	54127	54127	54127
1684	40826	40826	40826
1685	28836	28836	28836
1686	36546	36546	36546
1687	55198	54773	55198
1688	28365	28365	28365
1689	18838	18838	18838
1690	60469	60469	63049
1691	39591	39591	51650
1692	17923	17923	28615
1693	22899	22899	22980
1694	24593	24593	46504
1695	25987	25987	46375
1696	25175	25175	34138
1697	7114	7114	13288
1698	11764	11764	14324
1699	36496	36496	39451
1700	18281	18281	19376
1701	65708	65708	65708
1702	46426	46426	46426
1703	49701	49701	49900
1704	24996	24996	51956
1705	45170	45170	52685
1706	16264	16264	27745

reasons for why people migrated to new lands. "In the subsistence model, 'push' factors dominated migration decisions: migrants moved away from overcrowded settlements with their poor prospects for economic independence rather than toward better market possibilities". In the market model, the 'pull' of better prospects predominated: migrants moved toward chances for commercial agriculture rather than away from depressed conditions" (304-5).

But as McCusker and Menard note, "in practice, push and pull are of course difficult to separate--migration flows are best understood as responses to differences in anticipated income" (305). To determine "differences in anticipated income," "Malthusian" historians focus on differences in population density; "staples" historians focus on changes in the staples economy, particularly changes in staples prices.

In the final analysis, decisions to acquire new land can not be separated from decisions to migrate. Land speculators may have anticipated increased demand for land ahead of other planters, but the speculators' understanding of what created demand for land would not have been basically different from other planters. New land acquired value from individual men and women who voluntarily or involuntarily moved to the frontier to settle on the land. If men and women would not migrate then the land had no value, no matter how high tobacco prices rose. Migration and land acquisition could have been led by staples factors, Malthusian factors, or a combination

of the two, but migration and land acquisition were intricately linked.

All Chesapeake historians from Bruce to Wertenbaker to the present have acknowledged widespread land speculation in the colonial era. However, most of these historians have traditionally believed that land speculation did not lead to land engrossment and did not adversely affect the growth and development of the colonial Chesapeake. Wertenbaker claims that, because "large planters found it difficult to secure adequate labor, of necessity they had to break up their estates and dispose of them to the small freeholders" (49). The Browns find that "speculators sold their land, and because men could always patent land from the King, they had to sell at a price within the reach of the common man" (16). Clemens finds that "speculators had seldom withheld land from sale. Most acquired land in large blocks and sold it quickly; they profited not from artificially high prices but from the volume of their transactions" (75). Earle believes that "a few patrician planters may have helped raise land prices through social hoarding of land for their progeny or for social status, but in general, planters regarded land as a commodity" (209).

On the other hand, some historians have implied that the colonial land patent system was an elite land acquisition system. In Clemens's analysis, only "nonresidents--speculators, merchants, and provincial officeholders" took advantage

of the patenting process (72). Morgan implies that land patents, land speculation, and land engrossment were all one in the same (1975,218-221).

Clemens and Morgan, however, ignore small resident planters who used the land patent process extensively. In my examination of the patents from 1660-1703, out of 4251 patents for new land (including patents which combined new land acquisition with other sources of land acquisition), I found a median "new" patent acreage of 300 acres and a mode of 200 acres. A breakdown of cumulative new patent acreage by the 2758 patentees (using the namecoding system described in Appendix I) shows a median of 400 acres and a mode of 200 acres. This median cumulative acreage is slightly less than the acreage identified by Kevin Kelly as the approximate "size of the average freehold in Surry during the late seventeenth century" (1979,190), indicating the average patentee was not that much different from the average landowner.

However, large speculators did patent much of the "new" land. For the years 1660-1703, the mean "new" patent acreage was 546 acres with a standard deviation of 921 acres, indicating the presence of some very large patentees. Patents ranged from the 34 perches (approximately 2/10 acre) patented by Thomas Wells in James City on 26 October 1699 (Nugent 3:32) to the 20,000 acres patented by Phillip Ludwell, Tobias Handford and Richard Whitehead in New Kent County on 24 October 1673 (Nugent 2:130). The top 10% of the "new" patents

(1100+ acres) contained 45.0% of the land patented from 1660-1703. A breakdown of cumulative acreage by patentee shows even greater disparity with a mean of 858 acres and standard deviation of 1580 acres and the top 10% of patentees (1860+ cumulative acres) patenting 50.3% of all new patent acreage. (All such estimates of cumulative acreage are undoubtedly exaggerated by combining different people with the same name, including father-and-son combinations. For example, Robert Beverley patented a maximum 18,800 "new" acres between 1660 and 1703, but this was patented by both father and son.)

The patent system also provided a means for all land-owners, large and small, to reaffirm their titles. Patents for "new" land composed only 53.3% of all patents and 55.1% of patent acreage between the years 1660 and 1706. The rest of the patents are made up of patents for escheated land (6.7%), lapsed land (7.8%), dowry land (0.9%), deeded land (18.0%), patent renewal (9.0%), resurveyed land (0.6%), and inherited (or deed of gift) land (3.7%).

This analysis shows that the land patent process combined a great number of small patentees and a small number of great patentees. However, when any one person could only tend about four acres planted in tobacco a year (Morgan 370), and with an optimum acreage per person of 50 acres, even the smallest patentees appear to be indulging in land speculation and engrossment. Without additional information, this behavior can not be classified as either "subsistence" or "market," for

the additional acreage could have been held for other crops, pasturage, forest products, field rotation, speculation, children's inheritance (Easterlin 63-70), or so farm hands could be kept busy clearing and improving new land during the off-season (Lebergott 186).

Most local studies have shown that speculation in patented lands dominated the land market in every newly settled region of the Chesapeake. Once settled, land sales became the dominant means of land transfer. Kelly found that "a majority of all grants were eventually sold, either intact or in parcels, and... the average interval between their patenting and sale was brief--nine years during the 1660s and 1670s and only four years in the 1680s. This is even more true of the 54 percent that were subdivided rather than sold intact" (Kelly,1979,190). Clemens found in Talbot County that a "flurry of patenting activity soon led to extensive buying and selling of land" (72).

The Crown had a vested interest in preventing land engrossment. Engrossment would discourage immigration to the colony and encourage emigration from the colony, thus inhibiting any increase in tobacco production upon which the Crown was heavily dependent for revenues. As Hartwell, Blair, and Chilton pointed out in 1699, "in actual revenues the establishment of one planter on every fifty acres would result in returns from tobacco duties 200 times as great as would be derived from the same area unoccupied, even if quit-rents

should be fully collected" (Gray 1:400). One of the main purposes for the adoption of the headright as the basis for land acquisition was to intricately tie land to population to prevent engrossment. Other than the initial cost of land, engrossment should have been inhibited by two conditions which could lead to forfeiture of land tenure:

(a) failure to pay quit-rents of two shillings per hundred acres

(b) failure to inhabit and cultivate the land within three year ("lapsed land")

Quit-Rents and Land Speculation

The role of quit-rents in land acquisition patterns is not clear. In the most thorough survey of the quit-rent system in early America, Beverley Bond called Virginia's quit-rent system "the earliest and most successful of the quit-rent systems under the crown" (221). The rate established by the London Company of 2 shillings per 100 acres was retained through the entire colonial period. Through 1684, as Bond states, "the quit-rents were reserved in Virginia as a customary charge upon the land, but the British government paid little attention to collection, and allowed these feudal dues to come under local control" (221). After 1684, "the careful supervision of the auditor-general, William Blathwayt, assisted by the two governors, Nicholson and

Spotswood, converted a system of quit-rents that had previously been administered in an exceedingly careless fashion into an important source of revenue" (Bond 224).

Bruce believes that although there was a laxness in paying quit-rents at different times in the 17th century, "the quitrents were collected with a strictness on the whole" (560). "After the Restoration, Berkeley was instructed to 'no longer forbear,' and thereafter progress was made toward getting a majority of the landowners on the rent-roll. This fee was not a great burden on land under cultivation, for payment was made in tobacco at a rate which often cut the tax in half...but altogether the main obstacle was the indifference of the sheriffs in collecting the fee, together with the natural reluctance of the people to pay any sum however small. Occasional pressure of the governors upon the sheriffs gradually induced most plantation owners to pay at least the greater part of their dues, for the sheriff was empowered to seize goods if the quitrent was refused" (Voorhis 77).

What effect quit-rents had on land speculation and engrossment is uncertain. Apparently no land was ever seized for failure to pay quit-rents (Voorhis 77-78). Bond believes that, at least before 1684, the quit-rents had little effect on the holding of vast, undeveloped areas of land. "As there was no personal property upon these vacant lands, distraint, the usual means of forcing collections, was out of the question, and the only other possible measure, forfeiture of

the land, could not be employed in face of the popular opposition it was certain to provoke" (Bond 228).

An analysis of quit-rent acreages and land patent acreage by county reveals that most patent acreage did not escape the quit-rent lists. For the period under study, annual county quit-rent totals exist for the years 1663-1665, 1688, and 1702-1704.[1] Between 1665 and 1688, the increase in quit-rent acreage equaled 63.6% of the new patent acreage. Between 1663 and 1704, the increase in quit-rent acreage equaled a full 85.9% of the new patent acreage. These percentages do not represent a one-to-one correspondence between patent and quit-rent acreage because some pre-1663 patent acreage was undoubtedly added to the quit-rent list after 1663.

In order to get a better estimate of the percentage of patent lands which were recorded on the quit-rent lists, we need an estimate of total patent acreage. Since the data base does not extend before 1660 and since many patents are missing during the years 1659-1663, this might be difficult. However, a reasonable estimate might be obtained by assuming annual new acre patents for 1659-1663 was the same as 1664 (based on analysis of missing patents in these years) and by using Craven's headright totals (15) for the years 1634-1658 to determine earlier patent acreage.

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[1] For the years 1663-1665: Virginia Magazine of History and Biography 3:42-47; for the year 1688: Virginia Historical Register 3:181-188; for the years 1702-1704: C.O. 5/1313, ff. 436-437; C.O. 5/1314, ff. 113-114, ff. 436-437.

As Edmund Morgan notes, the headrights are highly correlated with new patent acreage (1973,369-370). Indeed, the annual new patent acreage to headright ratio is usually in the 45-50 range, as might be expected with the 50 acre per headright allowance. The actual ratio is somewhat less than 50 because headrights are also required for lapsed land patents and some patents do not claim all of the 50 acres due for each headright. For the years 1660-1669 the average ratio was 47.1, but ranged from 58.1 in 1660 to 38.6 in 1668. Using this 47.1 ratio and Craven's totals for the years 1634-1658 and patent estimates for the years 1659-1662, 1663 quit-rent acreage was found to be 46.3% of total cumulative acreage from 1634-1662. Extending this technique for the patents 1663-1703, 1704 quit-rent acreage was found to be 67.3% of total cumulative acreage from 1634-1703.

There were vast differences between individual counties in the patent acreage change to rent roll acreage change comparison for the period 1663-1704. Of the counties with relatively large patent acreage, most of the counties were in the 80-90% range, but Accomack (98.2%) and Surry (96.4%) contrasted with Nansemond (59.8%). Of the counties with relatively small patent acreage, Warwick (118.4%) contrasted with York (18.1%).

Overall, it does not appear that patentees were avoiding payment of quit-rents. This analysis does reveal a strong improvement in quit-rent enforcement in the period 1688-1702

when more acres (155.0%) were added to the quit-rent lists than were actually patented, which supports the beliefs of both Bond and Bruce that the system was improving. Interestingly, the system had improved sometime before 1702, at least two years before the celebrated 1704 "full" quit-rent list.

Michael Nicholls notes that, in the Southside, some land owners may have avoided quit-rents by holding land by survey without completing the land patent process (75). What little evidence I have uncovered tends to show this was not so for the colony as a whole. Lists of patents for lands for April 1706 and October 1706 found in Colonial Office records (C.O. 5/1315, ff. 134-136, 169-172) which lists dates of surveys indicate (out of 94 surveys) a mean gap of 11.4 months between survey and patent and a median gap of 8 months. This shorter time lag is much more in agreement with the statutory requirement that the plat be "returned to the capitol within six months of completion and a patent issued on the survey within six more months" (Nicholls 74).

Land Acquisition and Lapsed Land

Lapsed land played a significant role in early Virginia land acquisition, and became increasingly more significant with time. "The law allowed anyone to take up such land by proving to the governor and council that the claim was deserted" (Voorhis 74). For the time period 1660-1706, 619

patents (7.8% of all patents) for 421,000 acres (10.1% of all patent acreage) were for lapsed land. Comprising less than 5% of total land patents in the 1660s, patents for lapsed land rose to over 20% of total land patents in the 1690s. Between 1664 and 1706, while annual new patent acreage was decreasing at 1800 acres per year, lapsed land acreage was increasing at 200 acres per year.

This increasingly high percentage of lapsed land has been curiously ignored by historians. Historians have commented on the laxness with which the rules of seating were enforced and the general acceptance of that laxness (Bruce 555-556). Voorhis concludes that "throughout the seventeenth century the requirement that land be occupied and cultivated was practically a dead letter. If one absolutely ignored his land and neglected to protect his title when it was brought into question, then, indeed, he ran the risk of losing his property ...Search of the patent records has failed to reveal an instance of the forfeit and regrant of land for want of cultivation, in a case where the owner defended his rights" (74).

This laxness is confirmed by my analysis of the land patents. Large multi-tract, multi-county landowners lost relatively little of their land to lapsing, although most such great planters did lose some land due to lapsing. The average owner of lapsed land was a small landowner who had patented only one or two relatively small tracts, and who patented no other land after the date of lapsing. On the average,

patentees were allowed far more than the maximum three years to "seat" their plantation and the amount of time allowed actually increased over the 17th century. By 1700, the average time between original patent date and subsequent lapsed patent date was well over fifteen years.

The increase in lapsed land claims could reflect an increase in demand for lapsed land over new land. Lapsed land was undoubtedly more economically attractive than new land because it would have the benefits of all earlier patented lands, such as closer proximity to navigable waters. The patentee of lapsed land saved on surveying fees, but was required to go through the trouble of petitioning the General Court for the land.

However, more likely the colony-wide increase in lapsed land simply reflects the aging of the Virginia colony and the shortage of new land in the older parts of the colony. The colony-wide rise in lapsed land claims was mirrored in most counties. In each county, usually a few years after the end of a phase of rapid land acquisition, there would follow a phase of lapsed land acquisition. As Nicholls notes for the Southside (79), whether for social or economic reasons, new land was preferred over lapsed land as long as new land was available in the county. When new land was no longer available, demands for lapsed land increased.

Comparative Analysis of Land Patents and 1704 Quit-Rent List

Both Wertenbaker and Voorhis have examined the relationship of land speculation to land engrossment using the land patents and the 1704 quit-rent list. The 1704 quit-rent list includes, by county, the name of each land owner and his owned acreage in 1704.[2]

Viewing the quit-rent list, Wertenbaker was "struck by the number of little holdings, the complete absence of huge estates, the comparative scarcity even of those that for a newly settled country might be termed extensive" (53). Voorhis's calculations showed "some suggestion of the subdivision of larger grants by sale of land to freed servants and others, and by allotment among the children of deceased patent holders" (70). Indeed, the quit-rent list reveals a much more egalitarian society than the patent analysis. Breaking down individual landholdings by county (combining all tracts patented by or owned by the same individual in any one county but ignoring multi-county land holdings), the mean cumulative "new" acreage patented (1660-1703) was 683 acres (std. dev. 1200 acres) while the mean 1704 rent roll acreage

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[2] For this analysis, I relied heavily on a computer data base of the 1704 quit-rent list developed as part of the York County Project of the Department of Historical Research at the Colonial Williamsburg Foundation funded in part by National Endowment for the Humanities grant #RS-00033-80-1604. I am extremely grateful to Dr. Cary Carson and Ms. Linda Rowe for their help in obtaining access to this data base.

was 450 acres (std. dev. 782 acres). The median acreage was 344 patented acres versus 225 rent roll acres. The top 10% of patentees patented 48.2% of patented land acreage, but the top 10% of 1704 landholders only owned 44.7% of 1704 rent roll land acreage.

In a comparative analysis of individuals (using the name-coding system described in Appendix I) in both the patents and 1704 quit-rent list, as shown in Table II, only 20.7% of 1704 land owners had already patented land. Those land owners who used the patent process owned on average 350 more acres than those land owners who did not. Of those who had patented land, the mean year of first patent was 1683 and, interestingly, for the colony as a whole the average patentee on the 1704 quit-rent list had patented a mean 110 acres (median 57 acres) less than he owned in 1704.

There were wide differences between individual counties; for most counties, rent roll acreages actually exceeded patent acreages, indicating patentees were acquiring land by means other than patenting. New Kent, Northampton, Nansemond, and Isle of Wight counties undoubtedly had considerable land specualtion. However, these calculations most likely underestimate the difference of quit-rent acreage over patented acreage, especially due to the undercounting of quit-rent acreage (for example, in Nansemond County where undercounting was marked). The presence of several generations with the same given name (for example, the several Edmund Scarburghs

TABLE II

CUMULATIVE PATENT AND 1704 QUIT-RENT ACREAGE
COMPARATIVE ANALYSIS

County	Percent Patentees Among Landowners	Mean Year First Patent	Mean Matched Patent Acreage	Mean Matched Quit-Rent Acreage	Mean Non-Matched Quit-Rent Acreage
Charles City	21.1	1686	741.1	792.7	375.6
Essex	19.1	1677	529.6	571.9	375.8
Elizabeth City	8.7	1694	176.7	492.5	237.5
Gloucester	19.7	1678	374.1	684.6	364.3
Henrico	34.7	1686	985.0	1305.2	343.6
Isle of Wight	24.8	1682	737.0	688.2	518.7
James City	7.2	1681	244.7	1217.2	333.5
Lower Norfolk	33.0	1682	507.5	679.0	334.0
Middlesex	20.5	1691	174.7	807.0	303.4
Nansemond	35.4	1686	479.5	430.6	281.7
New Kent	17.9	1686	1051.9	479.5	430.6
Northampton	15.2	1674	1330.9	1141.7	432.5
Surry	19.1	1684	509.9	981.9	358.5
Warwick	12.6	1685	203.9	489.3	293.6
York	9.1	1684	259.0	678.1	276.5
All	20.7	1683	686.6	797.0	359.7

Note: Several counties were combined for this analysis: Accomack and Northampton; New Kent, King & Queen, King William; Lower Norfolk, Norfolk, and Princess Anne; Charles City and Prince George.

Source: See text.

on the Eastern Shore), also complicates the analysis in reflecting more family than individual landholdings and exaggerating the mean year of first patent and cumulative patented acreage.

This analysis shows that the average patentee did not speculate in land, but simply continued to accumulate lands by other means.[3] However, these averages disguise significant differences. Of the 1051 patentees who appear on the 1704 quit-rent list, 56.8% were accumulators, 38.9% speculators, and 4.3% held the same amount of land they had patented. Accumulators patented on average 441 acres (median 226 acres) but owned on average 1077 acres (median 650 acres). Speculators patented on average 1090 acres (median 600 acres) but owned on average 630 acres (median 260 acres). Those who owned the same as patented, the modal patentee, patented and owned on average 287 acres (median 200 acres). Tables III and IV show that large patentees were also large speculators and large land owners were also large land accumulators; likewise small patentees tended to be accumulators and small owners tended to be speculators.[4] A large land accumulator like

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[3] This level of analysis can not determine whether the the land owned in 1704 is identical to the land previously patented. Perhaps landowners sold the land they patented and purchased the land they owned. More local work will be required to determine the prevalency of such a practice.

[4] A multiple regression analysis yields the results:

$$\text{ACREDIFF} = 2164^{*} - 321^{*}\text{ACRES} - 5.2\ \text{DATEDIFF} - 94.3\ \text{FRON} + e$$
$$(11.4)\quad (9.4)\qquad (1.7)\qquad (0.8)$$
$$R^2 = 0.106$$

William Randolph and a large land speculator like Edmund Scarburgh, although demonstrating radically different land acquisition behavior, undoubtedly had much more in common with each other than with small accumulators and speculators. But, apart from William Byrd, father and son (who both patented and owned great tracts of land in Henrico County), the stereotypical patentee as land engrosser/speculator did not exist.

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and

$$\text{ACREDIFF} = -2128^{*} + 490^{*}\text{RRACRES} - 16.6^{*}\text{DATEDIFF} - 474.9^{*}\text{FRON} + e$$
$$(9.1) \quad (13.9) \quad (5.8) \quad (4.7)$$
$$R^2 = 0.183$$

where

RRACRES = 1704 county quit-rent roll acreage
ACRES = cumulative county new patent acreage
ACREDIFF = RRACRES - ACRES
DATEDIFF = 1704 - year of first new patent
FRON = dummy variable to measure the effect of the frontier where FRON=0 for the land-locked counties of Elizabeth City, James City, Warwick, Gloucester, Middlesex, and York; for all other counties, FRON=1

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses. For additional information on the use of statistics, refer to Appendix II.

This regression confirms the results of Tables III and IV but also indicates that rent roll acreage tends to be a much better predictor of land acquisition behavior than patent acreage. The analysis also shows that older patentees and frontier patentees are more likely to be speculators than accumulators. Inclusion of dummy variables to test the effect of regional differences other frontier effects showed no significant coefficients.

TABLE III

ANALYSIS OF NEW LAND PATENTEES APPEARING ON 1704 QUIT-RENT LIST BY CUMULATIVE COUNTY PATENT ACREAGE GROUPINGS

Cumulative Patent Acreage	N	Percent Speculators*	Mean Year First Patent	Mean Quit-Rent Acreage	Mean Acreage Difference*
0-100	178	3.9	1687	522.4	457.7
101-200	169	20.1	1686	474.2	318.9
201-300	130	31.5	1686	530.5	269.5
301-400	118	40.7	1683	642.0	280.9
401-600	141	54.6	1684	661.9	153.1
601-800	93	63.4	1680	628.4	-69.2
801-1000	59	47.5	1679	1272.9	353.0
1001-1500	63	69.8	1679	921.8	-332.0
1501-2000	37	73.0	1673	1630.7	-119.7
2001-3000	28	57.1	1676	2030.0	-338.6
3001-5000	18	72.2	1678	2600.0	-1120.8
5001-10000	15	93.3	1671	3292.1	-3427.6
10000+	2	50.0	1669	10750.0	-8552.0
All	1051	38.9	1683	797.0	110.4

* Mean acreage difference equals 1704 quit-rent acreage minus cumulative county patent acreage. Negative numbers, where patented acreage exceeds owned acreage, is considered evidence of land speculation for the purposes of calculating percent speculators in each group.

TABLE IV

ANALYSIS OF NEW LAND PATENTEES APPEARING ON 1704 QUIT-RENT LIST BY COUNTY QUIT-RENT ACREAGE GROUPINGS

Quit-Rent Acreage	N	Percent Speculators*	Mean Year First Patent	Mean Quit-Rent Acreage	Mean Acreage Difference*
0-100	100	68.0	1684	302.4	-216.2
101-200	182	62.6	1684	441.2	-268.7
201-300	137	42.3	1684	379.6	-111.3
301-400	116	52.6	1681	535.3	-167.7
401-600	140	30.0	1685	569.4	-49.3
601-800	86	22.1	1683	560.5	154.8
801-1000	77	18.2	1683	812.3	116.3
1001-1500	90	17.8	1684	784.0	478.1
1501-2000	45	15.6	1681	1375.9	409.1
2001-3000	37	10.8	1679	1521.0	1066.2
3002-5000	27	18.5	1679	2436.8	1289.7
5001-10000	10	10.0	1682	2393.4	4254.1
10000+	4	0.0	1669	7013.8	6908.5
All	1051	38.9	1683	686.6	110.4

* Mean acreage difference equals 1704 quit-rent acreage minus cumulative county patent acreage. Negative numbers, where patented acreage exceeds owned acreage, is considered evidence of land speculation for the purposes of calculating percent speculators in each group.

The patent system, although widely used for speculative purposes by large patentees, was on average a tool of neither land speculation nor land engrossment, but simply one of many means available for individual acquisition of land.

If the average patentee bought rather than sold land, then how did the other 80% of land owners come to acquire their land? Just as it is critical to note that most land owners in 1704 did not use the patent system, it is also critical to note that most previous patentees did not own land in 1704. Only 36% of the individuals who patented land between 1660 and 1703 appear on the 1704 quit-rent list. (The average patentee who did not show up on the 1704 quit-rent list had patented 655 acres compared to the 687 acres of the patentee who did show up on the list, so the two types of patentees were not that different.) Undoubtedly, most of the land patented since the days of the London Company had left the hands of the original patentee and been acquired by others through the many alternative ways of acquiring land.[5]

Did the land patent system as a whole result in engrossment of land? Many local studies have shown that a large minority (or even a slight majority) of the inhabitants of the colonial Chesapeake owned no land (Nicholls 66; Walsh, 1977,399; Earle, 1975,209; Kelly,1972,125; Morgan,1975,

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[5] Some of the patentees who did not show up on the 1704 rent roll might have been non-resident land speculators. If so, then this study shows that such speculation did not lead to land engrossment and the lands were dispersed in due time.

221-222). The picture of landlessness might actually be much bleaker. In comparing individuals named in patent headrights and land owners on the 1704 quit-rent list, Wertenbaker showed that "not more than five or six per cent of the indentured servants of [the Restoration] period succeeded in establishing themselves as planters" (97-98). In an independent analysis of the headrights and landowners (not just patentees but all indications of landholding) in the patent records, I found that 3.4% (N=10429) of the male headrights during the period 1660-1679 eventually became landowners, taking a mean 19 years to do so. For the period 1680-1699, only 0.6% (N=2934) of the headrights became land owners.[6] Why the great masses of headrights never show up in later records is not certain. Most likely many died during seasoning, emigrated, squatted on frontier land, or simply avoided county officials.

However, since land continued to be patented, bought, and sold in every county of the Virginia colony, and since there was much land left to be patented on the frontier and even in the older counties, as shown in Table V, it is difficult to prove that there was land engrossment. "New" land continued to be patented in substantial quantities in

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[6] These patent results can only be treated as low estimates since the patent records are not the best indicators of land ownership. For these estimates, only landowners who first appeared as headrights in the patent records were considered. For most headright-landowner matches, the person actually appears as a landowner before he appears as a headright.

TABLE V

COMPARISON OF 1704 QUIT-RENT ACREAGE
AND MODERN LAND ACREAGE

County	Percent Modern Acreage	Acreage Patented 1676-1703
Accomack	67.7	25,582
Charles City	44.2	47,529
Elizabeth City	81.0	3,474
Essex	87.9	54,504
Gloucester	74.0	29,055
Henrico	94.5	99,623
Isle of Wight	67.4	51,928
James City	113.7	9,058
King & Queen	77.9	100,641
King William	56.7	36,652
Middlesex	58.7	12,600
New Kent	128.1	110,333
Norfolk	45.1	66,280*
Northampton	69.9	7,735
Nansemond	50.7	77,257
Prince George	61.9	72,336
Princess Anne	57.3	53,788*
Surry	62.6	45,023
Warwick	78.4	5,887
York	76.9	7,300

* Lands of Lower Norfolk County (1676-1690) divided equally between Norfolk County and Princess Anne County due to difficulty of separation.

Source: Thomas Jefferson Center for Political Economy, University of Virginia, Statistical Abstract of Virginia: 1966. Charlottesville, Va., 1967. Patent Data Base

every county from the time of Bacon's rebellion in 1676 through the 1704 quit-rent list. Even if this land was considered marginal in 1676, the land was available in 1676 and it did not take long for the land to be reevaluated favorably. Although many of the percentages of modern acreage in Table III might be attributed to changes in definition of county boundaries, quit-rent abuse, or 17th century undersurveying errors (although oversurveying was probably just as much a problem), the general availability of land is confirmed by local studies. Lorena Walsh found that even with "the rise in land prices, and a concomitant increase in tenancy at the turn of the century...in 1705 only about sixty percent of the land in [Charles County] had been surveyed, much less settled" (1977,402-405).

But does the high level of landlessness indicate engrossment? The problem is how to define engrossment. If engrossment means that not everyone can own the "best" lands, to that extent there is always engrossment. If engrossment means that those who desire land can only obtain economically marginal land and are forced to migrate in order to obtain "good" lands, then land was probably engrossed in the colonial Chesapeake. If land engrossment means that landowners own more land than they or their family can possibly farm by themselves, then most landowners in the colonial Chesapeake engrossed land.

But if engrossment means that individuals who desired

land were thwarted at every turn by other individuals who monopolized all of the land or means of acquiring land, then the colonial Chesapeake was definitely not a region of land engrossment. Indeed, as long as land was available on the frontier and in marginally profitable areas for a fixed small price, land prices amd rents could not become exorbitant and a family farm was within the reach of the vast majority of white southerners. For those who could not afford the minimum capital cost of farm ownership, there was always tenancy.

And tenancy was, indeed, quite common throughout the early period of American history. Walsh believes "the explanation for a substantial rate of tenancy existing in an area where there was still land available virtually for the taking appears to lie in a complex inter-relationship between, among other things, soil quality, concentration of productive land, credit availability, and changing functions of tenancy itself" (1977,402-405). In a most thorough study of antebellum tenancy in Georgia, Bode and Ginter conclude that "tenancy makes land available, particularly to those those, such as younger sons who have not the capital to purchase" (6). Many studies of the early American North have shown that tenancy was a normal part of the "agricultural ladder" and life-cycle age stratification (Henretta 7-8). In the antebellum North, renting a farm was "an important step toward ownership" (Danhof 88). Tenancy was mostly a function of wealth; to move into land holding status required some threshold amount of

capital for investment which tenants lacked (Atack 24).

Freedmen who desired land, but for whom tenancy was beyond their economic means, could simply have squatted on unclaimed land. The abundance of land and the difficulty of policing the frontier undoubtedly allowed many landless to scratch out a living through squatting. That there are few mentions of squatting in the literature of the colonial Chesapeake might indicate that land was made legally available to the landless at terms they considered reasonable.

This is not to say that freedmen were unconstrained in their choice of tenancy, for constraints did exist. But to the degree that freedmen had a choice between land ownership, tenancy, and squatting, land was not engrossed. Each freedman simply pursued his self-interest in a social system which had never been and never would be egalitarian. Perhaps the issue of engrossment should be viewed from the perspective of the English laborer who had never owned and would never own land of his own. Although most Englishmen ideally would have preferred to own land free and clear, each freedman realistically weighed the advantages and disadvantages of leasing good land or migrating to good land versus patenting accessible poor land, including capital requirements, annual expenses, expected revenues, and risk factors.

That the freedman chose to be a tenant reflects, not engrossment, but simply the same self-interest which motivated people to emigrate to the New World and settle the frontier

in the first place. "Perhaps when a poor man considered the various ways by which he might make a living in the county, survey or purchase of a marginal freehold may not have appeared to him to be the best alternative. Leasing more productive land--even though this entailed the payment of substantial rents--may have produced higher or at least equal net incomes" (Walsh,1977,414). Likewise Carr and Menard, who found evidence of heavy migration from the Chesapeake at the end of the 17th century, believe that these freedmen emigrated "less out of a sense of despair than because they thought they could do better in the more recently settled and more rapidly growing American colonies" (1979,236237).

Although there is little evidence to show that the checks meant to prevent engrossment--quit-rents and lapsing--were effective, an analysis of these checks indicates they were at least in force during the second half of the 17th century and were much more likely to be effective than engrossment proponents would have us believe. Overall, there appears little evidence to show that potential land owners were prohibited from obtaining land, unless they were unwilling or unable to move to or patent the available land. What we might call land speculation or land engrossment, and indeed land acquisition, may be better lumped together "as a form of investment, promoted by colonial governments to provoke the opening and settlement of western lands and the concomitant economic development" (McCusker 334n). Overall we might

summarize, as Lewis C. Gray did for all the southern colonies, that "the various land policies did not seriously restrict the supply of land, although in time inertia of population and the tendency toward engrossment caused the better lands in older settled districts to appear scarce" (1:403).

Timing of Land Acquisition

Clemens's study of land acquisition on Maryland's Eastern Shore has some significant and testable specifications for the timing of land acquisition in the colonial Chesapeake:

> Chesapeake settlers had three principal options when they invested in the agricultural economy: patenting land, buying land, and purchasing labor. Because tobacco cultivation required little land in a given year, planters benefited when they responded to higher staples prices by purchasing a servant's contract rather than more farming acreage. On the other hand, patenting land, once a person had been transported to the Chesapeake, cost little additional tobacco...People consequently patented land when tobacco prices were high and servants were being brought to the Chesapeake" (72).

Interestingly, with such timing, land acquisition might be classified as more Malthusian than staples. Whether land is being acquired by great planters in order to put additional

servants on satellite plantations or by small planters who are moving to the frontier with their servants, both were acquiring land because of increased tithable population pressure on existing resources. Changes in land acqusition are only secondarily related to changes in tobacco prices. The primary cause of land acquisition is an increase in tithable population density. In this case, tithable population density is related to tobacco prices and so the staples model explains the general dynamics of land acquisition. But if tithable population density was found to vary as a function of factors independent of tobacco prices--if immigration was more a function of English wage conditions than tobacco prices or if tithable population increase was due more to natural increase of a creole labor force than immigration--then the staples model may not be as useable. Thus, for studies of land acquisition, the staples model may only be a subset of the more general Malthusian model.

However, there are problems with Clemens's timing argument. Clemens makes a claim for a capital-short society where planters could make only one decision at a time: acquire servants or acquire land. If, as Clemens states, "patenting land, once a person had been transported to the Chesapeake, cost little additional tobacco," why did the small planters who imported the servants not acquire land at the same time (72)? And why, if headrights are such a marketable commodity, is patenting land so dependent on importing servants in

Clemens's analysis (Clemens 71-72)? Most Chesapeake historians, since Edmund Morgan's criticisms, have been wary to equate headrights with immigration. What Clemens finds may have been true of Maryland's Eastern Shore, but certainly his analysis of land acquisition has not been proven for the entire Chesapeake.

Nevertheless, Clemens does identify the utmost necessity of determining timing of land acquisition with respect to changes in both tobacco prices and population density if we are to properly test the two theories. Central to any such analysis, especially considering the intricate bureaucratic procedure involved in patenting land, must be an independent assessment of how long the land patent process took. What was the time lag from the start to the finish of the land patent process?

As Gavin Wright shows, the effect of changes in the price of the staple may not have an instantaneous effect on demand for land. Indeed, Wright found that "a distributed lag function, with the weights assigned to past cotton prices declining geometrically with time" gave the best results (112,116). Land acquisition may be lagged due to the time taken to make a decision to acquire new land, to the time necessary to accumulate the required capital from the windfall of rising tobacco prices, to the physical time required to fulfill the various requirements of the patenting process. In colonial Virginia, the slowness of the colonial bureau-

cracy, the inefficiency of the Secretaries' Office, the shortage of surveyors, the difficulty of travel to Jamestown or Williamsburg, all may have effectively delayed the land patent process.

The only date reported on the land patents themselves is the date that the patent was finally issued, the finish date of the land patent process. In order to determine the start date, we need to examine independent sources. Referring back to Beverley's description of the land patent process, independent dates for headright certificates and surveys, available from both county records and other colonial records, might help establish a start date.

Edmund Morgan, using the excellent index to Nugent's Cavaliers and Pioneers, analyzed the time lag between headright certificate and land patent for several counties between the years 1645-1662. "With the aid of this index it is possible to trace the names from many county certificates to the land patent in which they were used. Where a certificate contains only one name, it is usually impossible to be sure that the same name in a patent is actually the same person. But where several names are on a certificate, as was usually the case, the same combination repeated in a patent makes the identification more certain" (1973,362-363). From this analysis, Morgan identified an average "gap between date of certificate and date of patent" of 20.4 months (as I calculate) (1973,363).

A comparable study was done for the years 1663-1706 using Stratton Nottingham's abstracts of headright certificates of Accomack County. The "gap" was tallied, not by number of headrights as Morgan did, but by number of certificates in order to determine the average patent time lag. Slightly less than half (44.0%) of the Accomack headright certificates were used by the person who initially obtained them with a median time lag of 7 months and a mean time lag of 13.4 months. A quarter (24.1%) of the headright certificates were used by persons other than the person who initially obtained them with a median time lag of 9 months and mean time lag of 26.0 months. A third (31.9%) of the headright certificates could not be traced to any land patent. Almost all of the Accomack County headrights which appeared did so in Accomack or Northampton County patents, indicating very few of the certificates were sold outside of the Eastern Shore. Most of the headright certificates were recorded in the years before 1675, but the time lag showed no discernible time trend over the entire time period 1663-1706.

Another estimate of the time lag between headright certification and patent was obtained by comparing a time series of county headright certification totals for the counties of Accomack (1664-1706), Lancaster (1664-1680), Northumberland (1678-1706), and York (1664-1706) with the Virginia land patent acreage series listed in Table I. In a multiple regression analysis with various time lags, as shown in Table

VI, the best estimate was obtained with a 0-1 year time lag, indicating that demand for headrights preceded the acquisition of land by at most one year. It is possible that demand for or supply of headrights lagged behind demand for land, but this analysis would tend to support low estimates of time lag between demand for land and acquistion of land.

The analysis reported in the section on land speculation showed that the time lag between survey and patent was a mean 11.4 months and median 8 months, which tends to agree with a two year time lag for the patent process. An example is Col. Tully Robinson and Jonathan West of Accomack County who patented 500 acres on 1 May 1706 (Nugent 3:105) based on a survey by Edmund Scarburgh for Tully Robinson of 28 September 1705 (C.O. 5/1315, 136) with 10 headrights combined from certificates of Mr. John Wise [West?], Sr. of 1 February 1703/4 and Capt. Tully Robinson of 3 February 1703/4 (Nottingham 62-63), a total process of 27 months.

Morgan was more concerned to show that the date of land patent was not the date of immigration than to determine the time required to patent land. However, the regularity of the one to two year time lag between headright certificate and land patent indicates that this is a reasonable estimate of the time necessary to patent land.

TABLE VI

HEADRIGHT-PATENT LAG ANALYSIS

Lag (Years)	Constant	HEAD	YEAR	D.W.	R^2
0	1729000*	79.50*	-1003*	1.53*	0.656
	(3.4)	(4.8)	(3.3)		
1	2212000*	47.69*	-1287*	1.63	0.526
	(3.7)	(2.4)	(3.6)		
2	1896000*	44.01*	-1100*	1.43*	0.492
	(3.2)	(2.4)	(3.1)		
3	2079000*	28.58	-1208*	1.20*	0.420
	(3.2)	(1.4)	(3.1)		

* denotes statistical significance at the 5% level of significance

Source: For headright certificates:
Accomack County (Nottingham, 1-64)
York County (Colonial Williamsburg abstracts)
Northumberland County (Virginia Colonial Abstracts, County Order Books #4 & #5)
Lancaster County (Virginia Colonial Abstracts, County Order Books #3, #3A & #4)

Note: For discussion of multiple regression analysis, see Appendix II.

$$ACRES = a0 + a1*HEAD\text{-}L + a2*YEAR + u$$

where

ACRES = Virginia new land patent acreage
HEAD-L = annual headrights registered at county courts lagged by L years
YEAR = patent year with 1664 as year 1

CHAPTER III

MALTHUSIAN FACTORS

Both the Malthusian and staples approaches tend to push aside other factors which might enter the land acquisition process. One such factor is the general loss of soil fertility over time. There is very little consensus on the role of soil depletion and erosion in migration and land acquisition decisions. Avery O. Craven, who was very Malthusian in his emphasis on "push" factors, believed that soil depletion was the major factor in the westward migration. Lewis C. Gray, an economic historian, noted that "the expansion of cotton and tobacco left an ever widening circle of lands suffering from soil exhaustion" (1:910). Peter Passell, a new economic historian of the "staples" school focusing mostly on soil depletion in the antebellum South, states that "tobacco grown along the Atlantic Coastal Plain caused chemical imbalance which, left uncorrected, significantly reduced crop yields" (933). However, Passell recognizes that, unlike the upland South and the Cotton Belt, "the Coastal Plain rimming the South from Virginia to Texas is virtually free of erosion damage...since these land[s] are quite flat" (935).

Most early American historians tend to downplay the importance of soil depletion and erosion. Carville Earle, following a staples approach, agrees with Craven and Passell that tobacco depleted the soil, "after which planters abandoned the field to nature and cleared a new parcel of land" (25). However, Earle believes "the abandonment was temporary while the 'old field' rested and recovered its fertility, a period of about twenty years. Through this cyclical shifting of fields, planters maintained tobacco yields" (25). Darrett Rutman, following a Malthusian approach, finds that "the demographic process men and women were caught up in seems more determinative than the soil on which they lived." He found "optimum density" independent of both soil type and topography (1975,284).

If planters combatted soil depletion by holding extra lands as Earle suggests, a higher "optimum density" would be established than without soil depletion. This "optimum density" would be a function of the particular staple since each staple depletes the soil differently. According to Earle, tobacco required at least 20 arable acres per laborer (29), although he also states that by the time of the American Revolution, 50 acres per laborer may have been considered the norm. Both Earle and Kulikoff quote the anonymous author of American Husbandry, who in 1775 wrote "'a planter should have 50 acres of land for every working hand; with less than this they will find themselves distressed for want of room'"

(Kulikoff,1986,48; Earle 210). Kulikoff believes that, beyond the 20 acres for tobacco production, planters required an additional 30 acres per laborer "to grow corn, pasture to graze livestock, and forests to construct and heat their homes, make fences, and build tobacco hogsheads" (1986,47-48).

However, if planters combatted soil depletion by acquiring new land, then demand for new land due to soil depletion would show up as a function of production land. (Only land planted in tobacco would be subject to depletion.) This could be proxied in two different ways: either as a proportion of cumulative patent acreage, or, perhaps even better, as a proportion of the total labor force (since any laborer could only work 2-3 tobacco acres annually).

In either case, the effect of soil depletion would show up in the coefficients of Malthusian factors rather than staples factors. Under the "optimum density" concept, there would be demand for new land when the population density was greater than optimum and no demand for new land when population density was less than optimum. Thus, in the long run, the population density would tend to stabilize around the optimum density. Under the Craven hypothesis, demand for land would show up best as a fixed positive fraction of the tobacco labor force, approximately one acre per year for each tobacco laborer.

Population Density and Optimum Density

In order to study whether the concept of optimum population density works in the colonial Chesapeake, we first need to study how population density in the Chesapeake changed over time. Two major problems in calculating population densities are (1) the definition of what land and population should be included and (2) the determination of the actual quantity of that land and population. Land could be defined, as Easterlin does, as all "potentially cultivable land in a given area" (72), but then the problem would be to define the area, for colonial Virginia theoretically stretched to the Pacific Ocean. Population could be defined as either labor force population or total population.

For colonial Virginia, the two most convenient options for determining the proper acreage would be to use either quit-rent acreage or cumulative patent acreage as an estimate of "owned" acreage, the "potentially cultivable land" to the present frontier. Both options have their drawbacks. Quit-rent acreages, as shown in the section on land speculation, tend to underestimate "owned" acreage, especially before 1684. Although cumulative patent acreage can be determined after 1660 from the land patent data base, determining pre-1660 cumulative acreage is problematical. Alternatively, one could use modern county soil maps, as several historians have done for local studies (Walsh 408-412; Earle 24-30), or 19th and

20th century census improved acreage totals used by others for overall studies (Easterlin 47-51; Yasuba 158-169), but it may not be advisable to apply latter-day concepts of "potentially cultivable land" to 17th century planters and to use such information would require an analysis of local land use beyond the scope of this study.

Annual tithable population totals for Virginia have been developed by Menard (1980,157-161), based on the earlier work of Edmund Morgan. The definition of a tithable changed slightly over the 17th century but it basically was a measure of the labor force, including all males and black females aged sixteen years and over. For several reasons, tithable totals are preferable to total population totals. First, the colony only kept records on tithables. Estimates of total population in the 17th century are interpolations based on data from two total censuses in 1625 and 1699. Second, and even more importantly, the tithable population might be the "preferred" population for consideration in testing the Malthusian hypothesis. The tithable population is the population that works the land. Although planters may need more land to raise a family, there is only so much acreage that a planter himself can tend before he needs an additional laborer. Nevertheless, planters may obtain additional acreage with the expectation of establishing a family farm, leaving an inheritance for their children, and allowing their grown children to live nearby. Most historians must not believe that the concept of

a "family farm" heavily influenced the development of the colonial Chesapeake, since all estimates of optimum density for the colonial Chesapeake, past and present, have essentially been expressed in terms of the tithable population. However, since much of the Malthusian influenced work has emphasized total population density (Rutman,1975,271), perhaps because of the New England emphasis on family farms and family inheritance, total population cannot be ignored.

For the purpose of testing the concept of optimum density, because of the problems associated with each method, population densities were calculated in several ways. Table VII presents population densities for the entire colony based on the method of headright-estimated acreage described in the section on quit-rent analysis. Table VIII uses the same technique, but reflects only land south of the Rapphannock River. Table IX also reports population density for land south of the Rappahannock River but cumulative acreage is interpolated between the 1663 and 1704 quit-rent totals using a 81.5% correction factor to convert patent acreage into quit-rent acreage. The tithable totals were determined using Edmund Morgan's tithable totals, correction factors, and ratio of tithables to total (1973,367-368).[1]

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[1] Tithable totals for land south of the Rappahannock were determined from county totals reported in Greene and Harrington for 1682 and 1699 (145-146) and in the Blathwayt Papers, Vol. XVII, Colonial Williamsburg, for 1673. The ratio of tithables to total for land south of the Rappahannock was slightly adjusted based on 1699 county totals.

TABLE VII

TOTAL VIRGINIA POPULATION DENSITY
(ACRES/UNIT POPULATION) BASED ON
INITIAL HEADRIGHT ESTIMATED ACREAGE

	Year					
	1644	1653	1662	1674	1682	1699
Cumulative Acreage	449852	929566	1980529	3186721	3488194	4022941
Uncorrected Total Tithables	4370	7190	11838	13392	15162	21956
Uncorrected Tithable Density	102.9	129.3	167.3	238.0	230.1	183.2
Corrected Tithable Density	97.8	122.3	157.8	224.4	205.2	172.9
Corrected Total Population Density	55.6	64.0	77.0	99.7	86.6	64.0

TABLE VIII

POPULATION DENSITY SOUTH OF THE RAPPAHANNOCK
(ACRES/UNIT POPULATION) BASED ON
INITIAL HEADRIGHT ESTIMATED ACREAGE

	Year			
	1662	1674	1682	1699
Cumulative Acreage	1476581	2366598	2610601	3144923
Uncorrected Total Tithables	9593	10852	12432	17093
Uncorrected Tithable Density	153.9	218.1	210.0	184.0
Corrected Tithable Density	145.2	205.7	187.5	173.6
Corrected Total Population Density	67.9	87.5	75.6	61.6

TABLE IX

POPULATION DENSITY SOUTH OF THE RAPPAHANNOCK
(ACRES PER UNIT POPULATION) BASED ON
1663 AND 1704 QUIT-RENT ACREAGE

	Year			
	1662	1674	1682	1699
Cumulative Acreage	654476	1384307	1599356	2061563
Uncorrected Total Tithables	9593	10852	12432	17093
Uncorrected Tithable Density	68.2	127.6	128.6	120.6
Corrected Tithable Density	64.4	120.3	114.9	113.8
Corrected Total Population Density	30.1	51.2	46.3	40.3

Source: See text.

All of the methods of calculating inverse population density seem to show a general trend: increasing dramatically through the 1670s, levelling off in the 1680s, and declining in the 1690s. Tables VII and VIII provide more realistic estimates of population density than Table IX, since quit-rent rolls underestimate cumulative acreage. Except for the 1662 estimate in Table IX, all calculated tithable population densities are well above 100 acres per tithable and thus far exceed 20 acre or 50 acre optimum acreages and show no trend toward declining to such low values.

But the concept of optimum density is not really meant to address the entire region of settlement, only subdivisions within the region of settlement. Earle focuses on one parish in Maryland and Rutman focuses on towns in New Hampshire. Even Kulikoff refers to "tidewater Virginia" or "southern Maryland," not the entire area of settlement of Virginians or Marylanders (1986,4849). For 17th century Virginia, the closest approximations would be an analysis of population densities at the county level, as presented in Table X for the years 1674 and 1699. In order to determine whether an optimum density operated as a "homeostatic governor" in colonial Virginia as Rutman found in colonial New Hampshire towns (1975,279), the counties in Table X were arranged into natural density groupings, following the logic of Wetherell's hierar-chical clustering recommendations (1977,109-116). The population change from 1674 to 1699 for each grouping was then

TABLE X

POPULATION DENSITY (ACRES/TITHABLE) BY COUNTY
BASED ON QUIT-RENT TOTALS

County	1674	1699
Accomack	281.3	232.2
Charles City	104.4	83.1
Elizabeth City	81.9	63.6
Gloucester	68.4	58.4
Henrico	135.5	190.6
Isle of Wight	143.9	169.5
James City	121.8	102.7
Lower Norfolk	129.0	157.2
Middlesex	84.6	73.0
Nansemond	62.5	143.5
New Kent	77.8	126.3
Northampton	306.3	192.4
Surry	172.5	165.9
Warwick	77.0	78.9
York	56.1	55.9

Source: See text.

calculated so that the effect of density on population growth could be analyzed. Table XI lists results based on 1674 density groupings and Table XII lists results based on 1699 density groupings (the preferred case since later quit-rent acreages are more accurate giving greater confidence to 1699 county density calculations and groupings).

Tables XI and XII reflect the general trend that Rutman found for New Hampshire of increasing population density (or decreasing inverse population density) leading to smaller population increases. However, the pattern is not nearly so clean, although some of this can be blamed on the small size of the sample. The groupings by density tend to create some strange bedfellows. Table XI combines in the 50-75 group: York County, where both acreage and population stabilized; Nansemond County, where acreage increased rapidly but population stabilized; and Gloucester County where both acreage and population showed steady growth. Population growth rates for the years 1674 to 1699 were 13.7%, -2.6%, and 49.0% respectively.

The concept of optimum density is problematic for the colonial Chesapeake because the concept implicitly assumes a fixed area of analysis, whether it be a parish, township, county, or "tidewater Virginia." The problem is, again, in defining "potentially cultivable land." Warwick and York counties, which by New Hampshire standards appear closest to an optimum density (both land and population stabilized), had

TABLE XI

PERCENT POPULATION CHANGE (1674-1699)
BASED ON 1674 DENSITY GROUPING

Density Group	N	Percent Change Population
50-75	3	20.0
75-100	4	56.5
100-150	5	69.6
150+	3	60.6

Source: See text.

TABLE XII

PERCENT POPULATION CHANGE (1674-1699)
BASED ON 1699 DENSITY GROUPING

Density Group	N	Percent Change Population
50-70	3	36.1
70-100	3	53.5
100-150	3	46.9
150-190	3	67.8
190+	3	67.7

Source: See text.

on the quit-rent rolls only 78.4% and 76.9% of their available land area, as shown in Table V. In both Warwick and York, land continued to be patented from 1674 to 1699, albeit only 5666 and 7109 acres respectively.[2]

The concept of optimum density must assume that the population is fairly evenly distributed over the area under consideration. If the population is concentrated in only one part of the region, as is the situation in a frontier county, then the population faces a much different "population pressure" than the calculated population density might indicate. To avoid this problem, patented land is used as the basis for determining population densities, rather than modern (or even 17th century) legal definitions of county boundaries. However, choosing patented lands as the basis means that the basis can change and thus the population density of a region might change independent of population changes. This is the case for Nansemond County where tithable population decreased by 2.6%, yet inverse population density increased from 62.5 to 143.5 acres per tithable, simply because more acreage was added to the quit-rent rolls.

The basic problem is that optimum density, the way Rutman defines it for New Hampshire towns, only explains population growth whereas, for the colonial Chesapeake, we are interested

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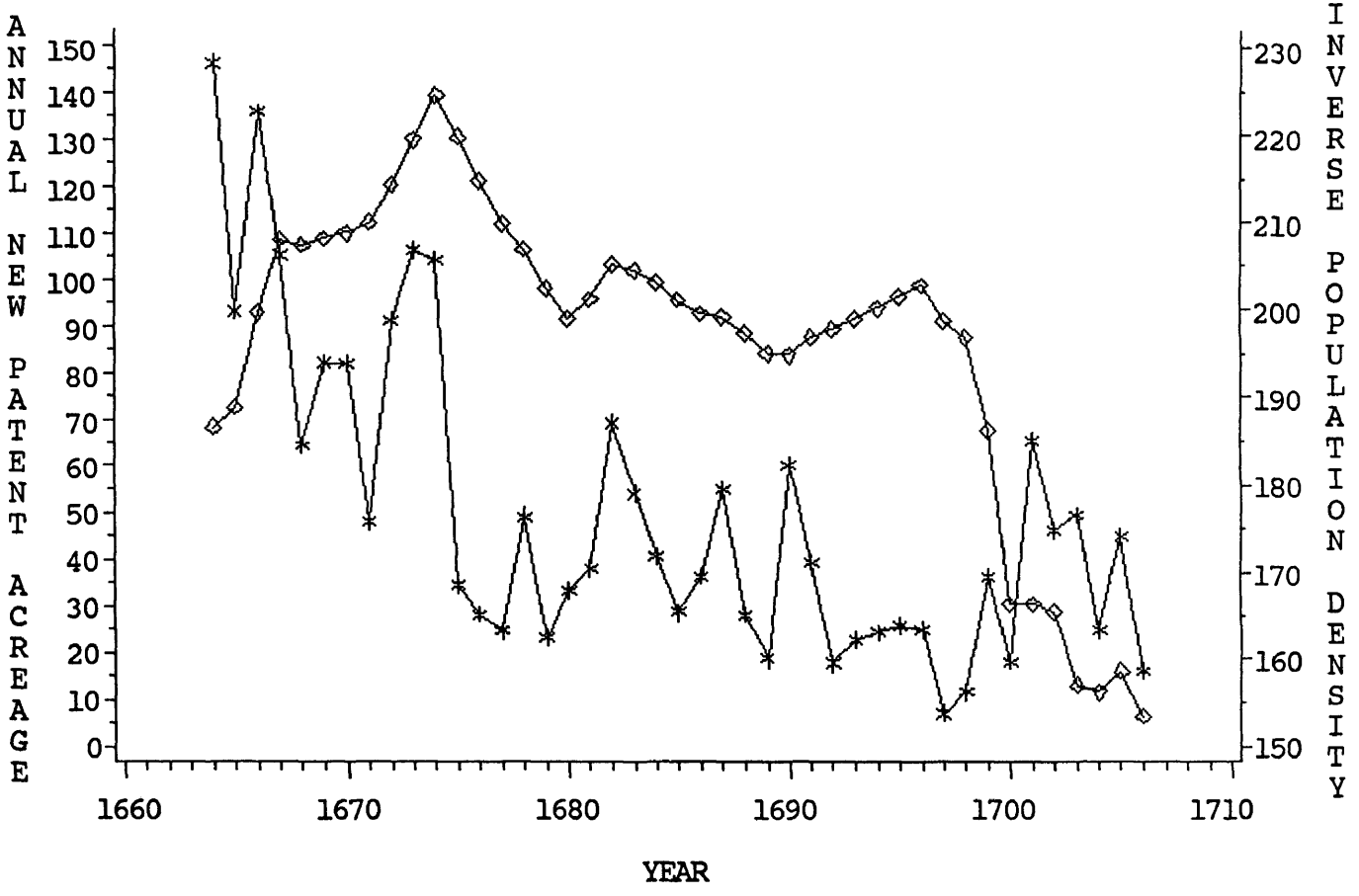
[2] However, a tract map of 1704 York County at the Colonial Williamsburg Foundation shows no available unpatented land for York County.

in both land acquisition and population growth and the inter-relationship between the two. For the colonial Chesapeake, the Malthusian model advocated by Richard A. Easterlin may serve better. In Easterlin's hypothesis, population density is just a proxy for farm values, or more simply, land costs. Higher population density leads to high land costs and subsequent reduced returns on investments which stimulates out-migration. Unfortunately, more work is needed to study local changes in population and land prices in 17th century Virginia before such a thesis can be tested.

For studies of new land acquisition, the concept of population density might work on a colony-wide basis; the general rise in land prices drives people to the frontier for less expensive land. But the concept of population density would seem illsuited to determining the specific frontier that patentees would choose. The land patent system equalized price of land at the frontier but the frontier could represent quite different types of land in different counties. Since the patentees would have had only limited knowledge of available land, perhaps such decisions were based on other criteria such as proximity to present location, personal contacts, etc.

It is conceivable that population change could be directly correlated with both population density and land prices. Figure I is a time plot of inverse tithable population density and new land patent acquisition. The upturn in land acquisition after 1700 might be attributed to the sharp

FIGURE I
NEW LAND ACQUISITION AS FUNCTION OF INVERSE DENSITY



<DIAMOND> VIRGINIA INVERSE POPULATION DENSITY (ACRES PER TITHABLE)
<STAR> ANNUAL VIRGINIA NEW PATENT ACREAGE (000 ACRES)

drop in acres per tithable. People migrated from higher priced, more dense areas to lower priced, less dense areas. This implies a simple supply-demand market for land. Kevin Kelly believes that the key to the tremendous increase in land acquisition in Surry County in the 1680s was "that its available interior land was inexpensive" (1979, 197). But does this explain the tremendous increase in patents there as well? As Kelly points out, these people are not speculating (1979,190). Why would people patent land in an area where land values were cheap? Wouldn't they patent the best land they could get?

Why people chose to patent land in different areas at different times is uncertain. Kelly believes that Surry only gained popularity after the Middle Peninsula and the Northern Neck lost their attraction (1979,197). As he points out "it was, after all, a change in the attitudes of prospective settlers toward Surry, and not a change in the conditions within the county--its geography, its unproductive soil, its relative lack of affluence--that affected its settlement" (Kelly,1979,204). Although we can hypothesize about why certain regions became "popular" at different times, why speculators and settlers were attracted to one region or another, the answer certainly is much more complicated than can be explained by population density.

The concept of an optimum density for the colonial Chesapeake is unrealistic unless one wants to consider an optimum

density which varies radically from place to place and time to time. Although this might be accounted for by changes in attitudes towards mobility, it is hardly likely. The closest concept to Rutman's optimum density might be the average density when a region changes from net in-migration to net-outmigration. For the Rutmans' Middlesex County, this occurred in the mid-1690s (1984,34) when inverse tithable density was about 70 acres per tithable. York County seemed to stabilize around 56 acres per tithable. Clearly more work at the local level will be necessary to verify such an optimum density. But even if identified, such an optimum density would address neither the tremendous turnover in people who emigrated from and immigrated to counties in spite of population density nor the steady rise in population density that occurred in almost all colonial Chesapeake counties over time due to natural increase.

Rather than an optimum density, we must think of "population pressure" as a relative concept, not an absolute concept. As Lewis Gray said, "the scarcity of land in older areas was not absolute, but relative to the great abundance of fertile land available in the frontier regions." "There was a tendancy with the passage of time for the older areas to develop a relative scarcity of easily available land of highest desirability, as a result of occupancy, progressive exhaustion of soil by single cropping, and the practice of holding large reserves...As this relative scarcity developed,

it motivated emigration and gave rise to some tenancy" (2:640-1).

CHAPTER IV

STAPLES FACTORS

The general organization of this analysis of staples factors of land acquisition follows the logic of Stanley Lebergott's essay "The Demand for Land: The United States, 1820-1860."

Expected Income from Land

"Expected income over the long term depends on the real price of the land's products" (Lebergott 197). As cotton was by far the major product of the land in the antebellum South, Lebergott proxied expected income using the deflated price of cotton in Charleston. "As real cotton prices rose so did land sales (t=3.7)" (201). Gavin Wright developed an alternative demand function for new land and likewise found "significant elasticity with respect to the cotton price" (116).

This should come as no surprise as most economic historians who have examined the antebellum era have noted the great role that cotton played in the development of the United States. "The vicissitudes of the cotton trade--the speculative expansion of 1818, the radical decline in prices in the

1820's and the boom in the 1830's--were the most important influence upon the varying rates of growth of the economy during the period [1815-1860]" (North 67). As summarized by Walton and Robertson: "It was of course the expected return on cotton that brought the great, irregular surges of movement into the southwest, and [as shown in a graph by North (124)] there is a close correlation between the price of cotton on the one hand and the volume of public land sales in Alabama, Florida, Louisiana, Mississippi, and Arkansas on the other" (199).

Any comparable study for the colonial Chesapeake suffers because tobacco price information is very meager and is often contradictory. The only series which can be used judiciously for the time period in question is Russell R. Menard's series of farm prices of Maryland tobacco 1659-1710 (1973b,85). He documents well the problems involved in developing such a series (1973b,80-81). However, using "a consistent and comprehensible source"-evaluations in inventories of estates--"there is every reason to believe that these evaluations reflect the current market value of tobacco" (1973b,82).

Menard believes that "although this price series is based on Maryland materials, there is no reason to assume that it cannot also be applied to Virginia" (1973b,84). He recognizes, though, that sweet-scented tobacco "brought prices as much as 50% higher than those paid for the coarser oronoco leaf" of Maryland (1973b, 84). The Rutmans showed that

Middlesex County tobacco prices were very different as the county shifted from oronoco to sweetscented tobacco. "In the 1670s the two areas [Maryland and Middlesex] were about equal, but by the 1690s Middlesex tobacco prices were roughly 130 percent of Maryland prices while in the first decade of the new century the differential neared 150 percent." Thus "planters moving to sweetscented in the 1660s and 1670s were spared the price collapse of the 1680s" (1984,5). However, as the Rutmans note, "there was a limit to which the sweet-scented supply could grow inasmuch as the variety had a restricted geographic range in the Chesapake. While oronoco would grow anywhere, sweetscented prospered only on the peninsulas between the James and Rappahannock rivers, an area largely settled and in production by 1700" (1984,6).

The effect of the introduction of sweet-scented tobacco on demand for land is hard to determine. The area "between the James and Rappahannock rivers" is quite large and the timing and distribution of sweet-scented tobacco production is not very certain. Certainly if Middlesex is any example then sweet-scented tobacco had almost no effect on new land acquisition since relatively little new land was left to be taken up after sweet-scented tobacco was brought into the county in the early 1660s. York, Warwick, and Elizabeth City Counties on the Lower Peninsula had even less land left to take up by the 1660s. However, the upper sections of the Lower and Middle peninsulas were expanding rapidly during this

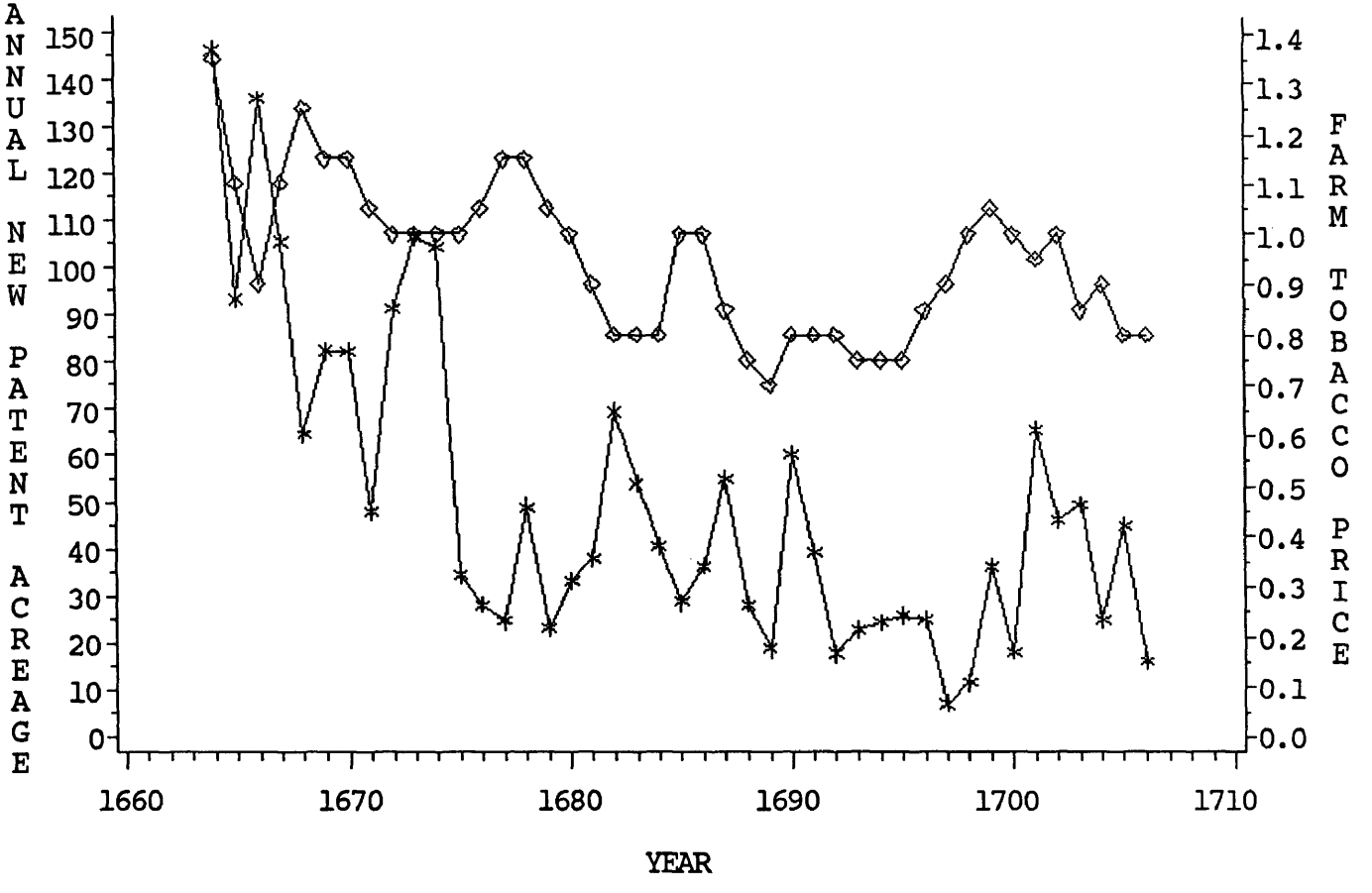
time period. Was this upper region settled with the intention of growing sweet-scented or oronoco tobacco? "Old" Rappahannock County which spread on both sides of the Rappahannock River showed the highest rate of land acquisition in Virginia in the 1660s, tapering off in the 1670s, but the rate was actually higher on the north side of the river where supposedly sweet-scented was not grown (13,390 acres/yr vs 9,350 acres/yr for the years 1662-1672, excluding all patents for which location was uncertain). Accomack and Northampton Counties on the Eastern Shore, where oronoco was grown, had only slightly lower rates of land acquisition during this period (9,650 and 7,620 acres/yr respectively). South of the James River, where only oronoco was grown, and Gloucester County, where sweetscented was grown, both had lower land acquisition rates which continued steadily through the 17th century.

A comparative analysis of land acquisition in the sweet-scented counties using Menard's oronoco price series and a sweet-scented price series provided by Lorena Walsh (based mostly on York County data for the 17th century) showed that Menard's oronoco series produced a more statistically significant correlation. The statistical difference probably reflects the scanty price data presently available on sweet-scented tobacco, but could reflect the primary importance of oronoco tobacco during the land acquisition phase of the Peninsula and Middle Peninsula.

Since the effect of sweet-scented tobacco on land acquisition is uncertain (and until better data is developed), Menard's oronoco tobacco price series will serve as the best proxy for Chesapeake land acquisition studies. Figure II is a plot of the annual Virginia new land patent acreage and Maryland farm tobacco prices, and like North's plot for the antebellum South (124), the two curves show a great deal of similarity. The upturn in new land acquisition after 1700, that in Figure I seemed correlated with a sharp decline in inverse population density, here seems strongly correlated with a sharp rise in tobacco prices.

Unlike North and Wright, Lebergott uses a "deflated" price of cotton in his analysis. Certainly any study of prices as a proxy for expected income should consider the effect of inflation or deflation. "Farming provided a cushion to buffer people in times of recession...but most colonists, to a greater or lesser extent, bought and sold in the market-place and thus felt the impact of the cycles of expansion and contraction" (McCusker 66). Unfortunately, there are no generally accepted consumer price indices for calculating deflated tobacco prices for the time period in question. Those indices that do exist are constantly being modified to reflect new data. However, all of the consumer price index

FIGURE II
NEW LAND ACQUISITION AS FUNCTION OF TOBACCO PRICES



<DIAMOND> NOMINAL FARM TOBACCO PRICES (PENCE STG PER LB TOBACCO)
<STAR> ANNUAL VIRGINIA NEW PATENT ACREAGE (000 ACRES)

series in general use show strong linear trends.[1] Since there is disagreement about the correct consumer price index, nominal prices rather than deflated prices were used for the bulk of this study, but deflated prices (using an index provided by Lorena Walsh of the Colonial Williamsburg Foundation) were run as an alternative test case.

Expected Capital Gains

"The value of farm land may well rise with the real price of crops. But capital gains in land can also derive from changes in the price of complementary services. Most notable of these is transport" (Lebergott 198). To index the improvement in transportation, Lebergott creatively (perhaps questionably) employs the federal expenditure on the Mississippi river system (199). Overall, for the late 17th century, expected capital gains should have declined as patents were sought further and further from navigable streams, thus increasing transportation costs. "Difficulties of transport as expansion moved westward constituted another influence tending to increase demand for land in more accessible districts" (Gray 1:404). Walsh shows that "planters showed

[1] Thus in models where a separate time trend is included with tobacco prices, t-statistics on tobacco price are not changed by the use of deflated prices; the effect of deflated prices merely shows up in the significance of the time trend. See Appendix II for explanation of the importance of t-statistics.

little interest in acquiring holdings in the interior" away from direct water access (1977,405). "The bulkiness of the leaf in shipment made easy access to water carriage most desirable" (Wyckoff 87) and thus interior lands would have been less valuable. However, if increasing land transportation costs were more than offset by decreasing water transportation costs (due to more efficient hogshead packaging, reduced port times, economies of scale, etc.), then it is possible that expected capital gains could have risen during this time period.

In Wyckoff's study of Maryland land values, he finds that values for both improved and unimproved land rose steadily throughout the 17th century (86). However, his focus seems to be strictly "waterfront properties," (87), and he does not provide any breakdown by county, water access, land policy, demographic growth, etc. A better understanding of these effects is revealed in a study of Surry County, Virginia, a growing 17th century county quite representative of colonial Virginia. Kevin Kelly found Surry's land prices much lower than Maryland's, except for a curious surge in the 1670s (see Figure III). The relationship between this price surge and new land patent acreage is remarkable. When new land was being patented land prices remained flat; but when new land was not being patented, land prices rose, dramatically so in Surry County in the 1670s when the population was rising rapidly. This long hesitation in new land acqusition in Surry

FIGURE III
SURRY COUNTY LAND PRICES AND NEW PATENT ACREAGE

<STAR> SURRY CUMULATIVE NEW PATENT ACREAGE (000 ACRES)
<DIAMOND> SURRY LAND PRICE FIVE-YEAR MOVING AVERAGE (LB TOBACCO PER ACRE)

County was unusual in its duration although many counties showed similar hesitations during the years surrounding Bacon's rebellion. Whatever the reason for the hesitation, when land patents resumed, land prices came back down. When land patents again declined in the 1690s, land prices began to rise again, but this time at a much slower rate and to a much lower level, probably reflecting the reduced desirability of remaining lands further from water transport. Similar rises in land prices at the end of patenting appear in other counties in the Chesapeake (for example Charles County [Walsh,1979,402-410]).

Wyckoff shows further that the net value of improved land over unimproved land was fairly stable in the late 17th century: 12 pounds of tobacco per acre in the 1670s; 11 in the 1680s; 13 in the 1690s (86). Thus, overall there seems to be little change in capital gains to land acquisition in the 17th century. As population increased, more land was made available, keeping the price of land quite stable in developing regions. A man could make a profit improving his homestead, selling it, and moving on, but there was little more advantage in the 1660s than 1690s.

Supply Price of Land

As in Lebergott's analysis, there were three elements in the price of land in the colonial Chesapeake: explicit price,

implicit price, and terms of sale. The explicit price was one headright for each grant of fifty acres (or the payment of a treasury right after 1699), plus some substantial fees.

Before 1666, surveyors fees were restricted by colonial statute to "twenty pounds of tobacco for every one hundred acres laid off" with a minimum fee of one hundred pounds of tobacco. After 1666, the fees were raised to forty pounds for each one hundred acres with a new minimum of four hundred pounds of tobacco. In addition, if the surveyor was "compelled to go so far from the place where he resided as to render return impossible in a day,...he was allowed thirty pounds of tobacco for every twenty-four hours included in the period of absence from home. If, to arrive at the place where the new plantation was to be laid off, he was forced to travel by water, the expenses of his transportation were to be borne by the person employing him" (Bruce 547-548). For the entire time period 1660-1706 the secretary's fees for drawing and recording a patent was 80 pounds of tobacco with an additional 30 pounds for a personal copy (Hening 1-463;2-144;2-355;4-60). During the governorship of Francis Lord Howard in the 1680s a fee of two hundred pounds of tobacco was charged for attachement of the seal of the Colony but this was discontinued in 1689 (Bruce 549-550). Fortunately for the small planter, these fees were not due until after the first crop of tobacco was produced, at which point it was collected by the Sheriff of the County (Beverley 278; Bruce 547-548).

The implicit price differed from explicit price because, as many historians have noted, headrights were a highly marketable commodity (Menard 324). Morgan found, in a study of six counties, that "a majority,though a small majority, of the [headright] certificates were used by the persons who initially obtained them" (363). Morgan believes that the great land acquisition surges in Virginia were financed by "drawing on a reservoir of unclaimed headrights. As the population of the colony rose, whether from a decline in death rate, from an increase in birth rate, or from an increase in immigration, it required no great acumen to foresee that land, hitherto abundant and not highly prized, would rise in value. Those who operated on a large enough scale to plan ahead accordingly began to gather and claim headrights. It did not cost them much--the going rate in the 1650s seems to have been 40 or 50 pounds of tobacco per headright. The rights for a thousand acres would have cost no more than a couple of cows or a couple of featherbeds" (368-369).

Morgan's estimate of the cost of headright certificates is based on a meager sample of two probate records, but it is not unreasonable. By 1692, according to contemporaries Hartwell, Blair, and Chilton, the "clerks in the office of the Secretary of the Colony [fell] into the grossly illegal habit of selling these rights to all who would pay from one to five shillings for each right, without any pretension being made that the buyer had complied with the law by bringing in

immigrants himself or by purchasing certificates from persons who had done so" (Bruce 523-524). At a pence per pound of tobacco, these fees are in line with Morgan's estimates of the market cost of headrights. Similarly, in 1699, the treasury right was set at "five shillings paid in coin" for each right of fifty acres (Voorhis 90).

The calculation of land price is further complicated by the widespread abuse of the headright system. Besides the clerks' acceptance of fees mentioned above, others have noted fictitious headrights, seamen or frequent travellers claiming themselves multiple times, and shipmasters and importers claiming rights for the same servants. According to Governor Spotswood, "for one individual who was brought over to Virginia, two hundred acres were frequently obtained by different persons" (Bruce 522). "The perversion was pushed so far that head rights were granted upon the presentation of lists of names copied from old books of record" (Bruce 523).

As Bruce has noted, "these abuses crept in with the general consent" (524). The demand for land was greater than the supply of headright certificates. Using the computer data base to search for common name patterns among headrights, I calculate that approximately thirty percent of the Virginia headrights listed in the land patents were duplicates. A third of this number are easily identified as the serial form of abuse mentioned by Bruce, where names are apparently copied from "old books of record." The other two-thirds are esti-

mated from the percentage reappearance of names so uncommon as not likely to be different people with the same name.[2] Contrary to most historians, though, I find this abuse dominant, not just in the later years of the 17th century, but from the mid-1660s to 1706. Extension of the patent data base before 1660 undoubtedly would help discover additional abuse in earlier time periods. The abuse was generally spread through all counties and among all types of patentees, although large patentees had a slightly greater proportionate share of the abuse.

The total cost for patenting five hundred acres (an average patent size) could thus amount to over a thousand pounds of tobacco. With annual labor productivity averaging about 1600 pounds of tobacco per person (Menard,1980,145), this represented a substantial part of a small planter's first tobacco crop. There is no indication, however, that the explicit or implicit costs of land acquisition varied during the time period 1660-1706 (except for the increase in surveyor's fees in 1666).

Quality of Land: Indian Cessions

Lebergott believes that "each additional Indian cession [of land]...improved the quality of federal land, thus

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[2] See Appendix I for explanation of namecoding system and methods employed to identify headright abuse.

implicitly cutting its price," as fears of Indian attack were reduced (Lebergott 201). As Indian tribes ceded land to the United States in the antebellum South, so was Indian land opened up to settlement in the colonial Chesapeake. In order to preserve the peace with the Indians and to keep the population of the colony as compact as possible, "except during the early years of the seventeenth century, there was always a limit beyond which settlement was not legally allowed to proceed" (Voorhis 73). As Gray notes, "although the irrepressible squatter might penetrate areas still within the scope of Indian tribal rights, the majority of settlers were compelled to await extension of the frontier through successive treaties of cession" (1:404).

The only major Indian acquistion during the time period under study was in 1688 when "the tribes residing in Pamunkey Neck and on the south side of Blackwater River, offered a petition to the Assembly, in which they urged that all lands in their vicinity they were unable to use should be granted to the English, not only as a means of protection to the petitioners, but also a relief to them in their indigent conditions" (Bruce 1:499). A study of the early land acquisition phase of the Pamunkey Neck offers an excellent example of the effect such Indian acquisitions had on both speculation and general land acqusition.

Lying at the head of the York River, between the Mattaponi and Pamunkey Rivers, the Pamunkey Neck became part of

King & Queen County when that county was formed in 1691. On 25 October 1695, four colonial leaders: Col. Edward Hill; Col. Richard Johnson; Ralph Wormeley, Esqr., Secretary of Virginia; and Edmond Jenings, Esqr., patented a total of 22,595 acres, the first land in the Pamunkey Neck (Nugent 3:1-3). Unfortunately they had jumped the gun because King William had given first choice of 10,000 acres to the "Royall Colledge of William & Mary in Virginia" (Nugent 3:31). They were forced to surrender their land in October 1696, only to take up the same in October 1699. Thus an Indian cession in 1688 helped contribute to a peak in new land patent acreage in 1699. The opening up of land in the Pamunkey Neck directly contributed to the surge in land acquisition from 1699-1705, although tobacco prices were falling. King William County, formed in 1702 out of the Pamunkey Neck, was one the fastest growing counties in the early 18th century.

Quality of land considerations are not restricted to Indian cessions, but affect demand for land in all regions of the colonial Chesapeake. "Land values, of course, varied according to the grade of land in a particular area, especially in the distinction between upland and alluvial" (Gray 1:405). Walsh shows that transport and quality usually went hand in hand; lands which lacked direct water access also tended to be less suited to tobacco culture (1977,405,408). Thus, consideration of capital gains will not be based solely on transport, but must also take into account quality of land.

CHAPTER V

LAND ACQUISITION MODEL PRESENTATION AND ESTIMATION

The model presented here includes three basic equations for (1) land acquisition, (2) population change, and (3) tobacco prices. Land acquisition can serve as a dependent variable affected by such factors as population changes and tobacco prices, but land acquisition can in turn act as an independent variable affecting population changes and tobacco prices. Even more importantly for the purposes of this study, tobacco prices and population changes can have a quite significant and immediate impact on each other. Before we can properly apply multiple regression techniques to an analysis of land acquisition, we must insure that, at any given time, there is no "simultaneous" interaction between the three variables, that we are truly able to distinguish the direction of the causal arrow. If we were not certain of the direction, then we would have to use more sophisticated statistical tools than multiple regression. Thus models of population change and tobacco prices will also be developed but, unfortunately, not as rigorously as the model of land acquisition because of a shortage of information about demographic processes and the tobacco market in the 17th century Chesapeake. For further

explanation of the statistical techniques employed in this paper, see Appendix II.

Model of Land Acquisition in the Colonial Chesapeake

Based on the two theories--staples and Malthusian--and a general analysis of the associated factors and available data, the basic demand function for land has been written in terms of lagged price and lagged inverse population density and a time trend. The time trend will be used to capture linear changes in expected monetary return, effective supply price, and attitudes towards mobility for lack of more specific information; non-linear changes in these variables will be captured in the residual.

The basic demand function for land is thus:

$$ACRES = a0 + a1*TOBO\text{-}2 + a2*DENS\text{-}2 + a3*YEAR + u \quad (1)$$

where

ACRES = new land patent acreage

TOBO-2 = nominal farm tobacco prices lagged by two years (pence sterling per pound of tobacco)

DENS-2 = TACR-2/POP-2

TACR-2 = cumulative patent acreage lagged by two years

POP-2 = tithable population lagged by two years

YEAR = patent year with 1664 as year 1

The base patent acreage was back-calculated from the 1704 quit-rent totals, including Northern Neck grants listed in the patents, but sensitivities were run based on alternative methods for determining base patent acreage. I also tested variations on this model using TOBO-2, DENS-2, TACR-2, and POP-2 in different combinations to test other plausible ways of deriving econometric models from the two theories. It is expected that the signs of TOBO-2 and POP-2 will be positive, while DENS-2, TACR-2, and YEAR will be negative. The time trend will be negative due to the reduced desirability of land further and further from navigable waters and due to reduced willingness to migrate as Chesapeake society matured. If the staples hypothesis is correct, we would expect to find a significant positive coefficient for tobacco price (TOBO-2). If the Malthusian hypothesis is correct, in this specification of the model, we would expect to find a significant negative coefficient for inverse population density (DENS-2).

Model of Population Change in the Colonial Chesapeake

In this era before the emergence of a stable native society, changes in population were mostly due to immigration from England. There is much disagreement among historians over how the labor market for indentured servants worked in the 17th century Chesapeake, especially over whether "push" or "pull" factors were more important. However, as with the

question over the correct model for land acquisition, since most historians accept that both "push" and "pull" forces were at work, these forces shoud be tested within the context of one model. Using a lagged English wage index as a proxy for "push" factors and lagged tobacco prices for "pull" factors, an equation for changes in population, plus a time trend to account for population changes due to natural increase, was developed:

$$DPOP = b0 + b1*WAGE\text{-}1 + b2*TOBO\text{-}1 + b3*YEAR + v \quad (2)$$

where

DPOP = change in tithable population from previous year

WAGE-1 = the Wrigley-Schofield English wage index lagged by one year

TOBO-1 = nominal farm tobacco prices lagged by one year

YEAR = tithable population year with 1664 as year 1.

The independent variables are lagged by one year because changes in population were due to the previous year's migration. The timing of harvests in both England and the Chesapeake and the physical time of transport across the Atlantic dictated a one year lag. However, the time lag of tobacco prices is not so clear cut because there are still a lot of unanswered questions about the 17th century European tobacco market. If English tobacco merchants were the major entrepreneurs in recruiting and marketing indentured servants and they

foresaw increased demand for tobacco, there might be no time lag effect on prices. If Chesapeake tobacco planters were the major entrepreneurs in the servant trade, a tobacco price lag of two years might not be unreasonable. If emigration from the Chesapeake was a major factor in population changes, then no time lag might be reasonable as transient people chose to leave or stay based on current tobacco prices. Thus, alternative models with no time lag (TOBO-0) and a lag of two years (TOBO-2) on tobacco prices were also estimated. It is expected that the sign of TOBO and TIME (due to natural increase) will be positive, while the sign of WAGE-1 will be negative.

Model of Tobacco Prices in the Colonial Chesapeake

The price of tobacco is a function of both supply side and demand side factors, complicated by two markets separated by an ocean. Unfortunately, there is not enough information to determine independent equations for supply and demand. Insufficient data is available for overall tobacco production and for European tobacco prices. Most historians have assumed price-inelastic demand and income-inelastic demand for tobacco. Indeed, until there is better information on the 17th century tobacco market, the best proxy for tobacco demand is a simple time trend. Although transportation costs and labor productivity may have changed over the course of the

17th century, there are likewise no better estimates for these data than linear time trends. Thus the best model we have for farm tobacco prices includes lagged cumulative acreage and tithable population for supply side changes and a time trend for demand side and other changes:

$$TOBO = c0 + c1*TACR\text{-}3 + c2*POP\text{-}1 + c3*YEAR + w \qquad (3)$$

where

TOBO = farm tobacco prices

TACR-3 = cumulative patent acreage lagged three years

POP-1 = total tithable population lagged one year

YEAR = tobacco price year with 1664 as year 1

Also tested was a variation of this model with the Wrigley-Schofield English wage index lagged by one year (WAGE-1) as a proxy for demand changes.

The population is lagged by one year because this year's tobacco price is based on last year's harvest. A time lag of three years for cumulative patent acreage is used as an approximation of how long it took for new patent acreage to be put into production. Having no better information for the antebellum South, Gavin Wright tried lags of two, three, and four years with little statistical difference (115). Douglass C. North noted "there was a lag of approximately four years between the peak in land sales and a large increase in cotton production" in the antebellum South (73). Lacking any better

information for the colonial Chesapeake, lags of three years (TACR-3) and four years (TACR-4) were tested. It is expected that the signs of TACR-L and POP-1 will be negative, while the signs of WAGE-1 and YEAR will be positive (reflecting the increased demand for tobacco over time).

Estimation

Since the resultant system of equations involve lagged, predetermined variables, there is no problem of simultaneity. We may thus estimate the coefficients using ordinary least squares (OLS). To determine whether there are any autocorrelation problems normally associated with such time series data, a Durbin-Watson (D.W.) statistic is reported for each model.

Results

Land Acquisition (ACRES)

Table XIII contains the results of the OLS regression on ACRES using nominal farm tobacco prices. Based on F-statistics, all of the models show statistical significance

TABLE XIII

MODEL OF LAND ACQUISITION (ACRES)
IN THE COLONIAL CHESAPEAKE, 1664-1706

Model	Constant	TOBO-2	DENS-2	TACR-2	POP-2	YEAR	D.W.	R^2
1	296054*	1413	-	-0.103*	3.444	1946	1.91	0.708
	(3.1)	(0.1)	-	(3.8)	(1.2)	(1.2)		
2	299667*	-	-	-0.104*	3.468	1967	1.91	0.708
	(4.6)	-	-	(5.0)	(1.2)	(1.3)		
3	278945*	19060	-1007*	-	-	-2226*	1.77	0.686
	(3.6)	(0.8)	(3.8)	-	-	(5.0)		
4	-1732	75745*	-	-	-	-1026*	1.43*	0.572
	(0.1)	(3.3)	-	-	-	(2.8)		
4AR1	5996	70281*	-	-	-	-1123*		0.466
	(0.2)	(2.6)	-	-	-	(2.4)		
5	227910*	-	-1130*	-	-	-2497*	1.75	0.682
	(7.3)	-	(5.3)	-	-	(9.2)		
6	200798*	9092	-	-0.078*	6.037*	-	1.84	0.696
	(3.8)	(0.4)	-	(4.5)	(2.9)	-		
7	218589*	-	-	-0.082*	6.386*	-	1.84	0.695
	(12.2)	-	-	(6.8)	(3.5)	-		
8	-53503	117404*	-60	-	-	-	1.29*	0.487
	(1.0)	(6.1)	(0.3)	-	-	-		
9	-65774*	117847*	-	-	-	-	1.29*	0.486
	(3.5)	(6.2)	-	-	-	-		
10	88033	-	-191	-	-	-	0.60*	0.009
	(1.4)	-	(0.6)	-	-	-		

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses.

at the 5% level of significance.[1] The signs of the coefficients are all as expected, except for the time trend in Models 1 & 2, where it is statistically insignificant. Thus, the positive sign on the time trend of Models 1 & 2 is less certain than the negative sign on Models 3, 4 & 5. This would tend to support the belief that land acquisition was declining due to reduced desirability of land, even after taking into account both tobacco prices and population density.

The coefficients on population (POP) in Models 1 & 2 have the correct sign (increased population led to increased demand for land and vice-versa) but are statistically insignificant. Models 1 & 2 indicate that increased cumulative land patent acreage was more important in inhibiting further land acquisition than increased population was in promoting land acquisition.

A Chow test[2] was run to test the contention that there was a transformation in the tobacco economy of late 17th century Virginia, that there was a different function for land acquisition in the first half (1664-1685) and the second half (1686-1706) of the time period under study. For all of the

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[1] Using Sargan's test (Maddala 210), the possible autocorrelation in Model 4 was determined to be an error specification problem, not a model specification problem. The error problem in Model 4 was corrected using an autoregression with a one year lag (Model 4AR1) and the results likewise presented in Table XI.

[2] A Chow test is an "analysis-of-variance test" which tests whether the calculated coefficients are constant over the entire time period under study. For more information, see Maddala 130-137.

models in Table XIII, there was no statistical difference between the two data sets at the 5% level of significance, thus rejecting the contention of a transformation.

The effect of tobacco prices on land acquisition is rather difficult to determine. Based on the models which combine both staples and Malthusian factors (1 & 3), tobacco prices would be dismissed as statistically insignificant. Dropping tobacco prices in Model 2 barely alters the results of Model 1. However, Models 4 & 4AR1 with land acquisition simply a function of tobacco prices and a time trend, essentially the "staples" model, indicate statistical significance for the tobacco price coefficient at the 5% level of significance. In such a situation, where the hypotheses are "nonnested since the explanatory variables under one of the hypotheses are not a subset of the explanatory variables in the other," the Davidson and MacKinnon's J-test is appropriate for testing the two hypotheses (Maddala 443-445). This test basically confirmed the results of Models 1 & 3 and led to rejection of the staples thesis and acceptance of the Malthusian thesis. Thus, the Malthusian hypothesis seems well-supported by the study of land acquisition in the colonial Chesapeake.

Rejecting the staples thesis, either Malthusian Model 2 or Model 5 could be considered appropriate. Model 5, the simplest of the Malthusian models, expressing land acquisition as a function of only inverse population density and a time

trend, is in many respects the best model. The intercept is quite precisely determined and the time trend shows statistical significance. For statistical as well as aesthetic reasons, Model 5 is the preferred model.

Model 5 can be used to determine "optimum density," the inverse population density at which there would be zero demand for land. Setting YEAR=1, the optimum density for 1664 was 199 acres per tithable; for YEAR=43, the optimum density for 1706 was 107 acres per tithables. The strong linear decline in optimum density supports the hypotheses that optimum density was not a constant in the colonial Chesapeake and that attitudes towards mobility were becoming more restrictive with time.

Using deflated tobacco prices had negligible effect on the results (Table XIV). Excluding Northern Neck land grants did reduce the significance of the coefficients, but not enough to change the conclusions of this study. (Population estimates for the area south of the Rappahannock were based on Menard's annual tithable series corrected by linearly interpolated population ratios estimated from available county tithable lists.) For a proper analysis of land acquisition in colonial Virginia, the Northern Neck appears to play a significant role and the patent data should be enlarged to include available Northern Neck patent data.

The inverse population densities in Table XIII were calculated based on Craven's headrights for the years 1634-

TABLE XIV

SENSITIVITY ANALYSIS OF LAND ACQUISITION (ACRES)
IN THE COLONIAL CHESAPEAKE, 1664-1706

Model	Constant	TOBO-2	DENS-2	YEAR	D.W.	R^2
Base Case	278945*	19060	-1007*	-2226*	1.77	0.686
	(3.6)	(0.8)	(3.8)	(5.0)		
Deflated Tobacco Price	279235*	24312	-1003*	-2353*	1.77	0.687
	(3.7)	(0.8)	(3.8)	(7.3)		
Total Population Density	321699*	21133	-2613*	-3598*	1.76	0.686
	(3.6)	(0.9)	(3.8)	(4.8)		
Post-1690 Northern Neck Patents	300953*	14628	-1105*	-1956*	1.71	0.644
	(3.9)	(0.6)	(4.1)	(4.6)		
Non-Northern Neck Patents	209018*	10388	-842*	-921*	1.34*	0.463
	(2.9)	(0.5)	(2.9)	(2.8)		
Quit-Rent Base Acreage	208796*	9466	-1062*	-1168*	1.84	0.698
	(3.6)	(0.4)	(4.0)	(3.8)		
Lapsed Land	-14680	-6804	-134	34	2.20	0.232
	(0.1)	(0.3)	(1.9)	(0.3)		
Patents <500 Acres	67090*	5776	-245*	-477*	1.24*	0.536
	(2.7)	(0.7)	(2.9)	(3.4)		
Patents <1000 Acres	140161*	5779	-502*	-1017*	1.53*	0.616
	(3.5)	(0.4)	(3.6)	(4.4)		
Patents >1000 Acres	95913	12683	-482*	-619*	1.66	0.505
	(2.0)	(0.6)	(2.2)	(2.5)		

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses.

1658. Alternatively, density was calculated based on the lower quit-rent acreage and the results are listed in Table XIV and shows little statistical difference over the base case. This is to be expected as changing the base acreage merely shifts the cumulative acreage curve up and down and does not change its general shape.

Lapsed land acquisition, listed in Table XIV, shows a similar result to the other models, although the overall correlation is weaker. Population density, although barely insignificant at the 5% level of significance, still far outweighs the effect of tobacco prices. Interestingly, there is no significant time trend, indicating that the increases in lapsed land acquisition over time noted earlier were due mostly to declines in inverse population density.

The contention that the behavior of small patentees differed from large patentees was also tested and the results are also listed in Table XIV. The patents were divided into three groups: greater than or equal to 1000 acres, less than 1000 acres, and less than 500 acres. Although the significance of the coefficients declined with each sub-group, each sub-group fits the general model. If anything, large patentees seem to be the least predictable group. Overall, though, it appears that the small planter/speculator responded to the same pushes and pulls as the large planter/speculator.

Population Changes (DPOP)

Table XV contains the results of the OLS regression on population changes (DPOP) using nominal farm tobacco prices and the English wage index. The results are also presented graphically in Figure IV. Based on F-statistics, all of the models show statistical significance at the 5% level of significance. The signs of the coefficients are all as expected, but not always statistically significant. Both graph and table indicate that tithable population grew most rapidly when English wages were low and tobacco prices high and tithable population grew least rapidly when English wages were high and tobacco prices low. All of the models show a statistically significant positive time trend which would be expected if natural increase was a growing part of population increase. Although colonial death crises may have significantly impacted the rise in tithable population in some years, the effect of such crises was not significant enough to distort the relationship between population change, English wages, and tobacco prices.[3]

The significance of the coefficients of the lagged

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[3] However, as determined by a Park-Glejser test (Maddala 162-167), the models are all heteroskedastic with time which may weaken the results. This heteroskedasticity in the residuals is due to greater precision in the population data at the end of the time period. The early population figures are based on interpolated averages but the later figures are based on actual colony-wide census records which show greater fluctuations.

TABLE XV

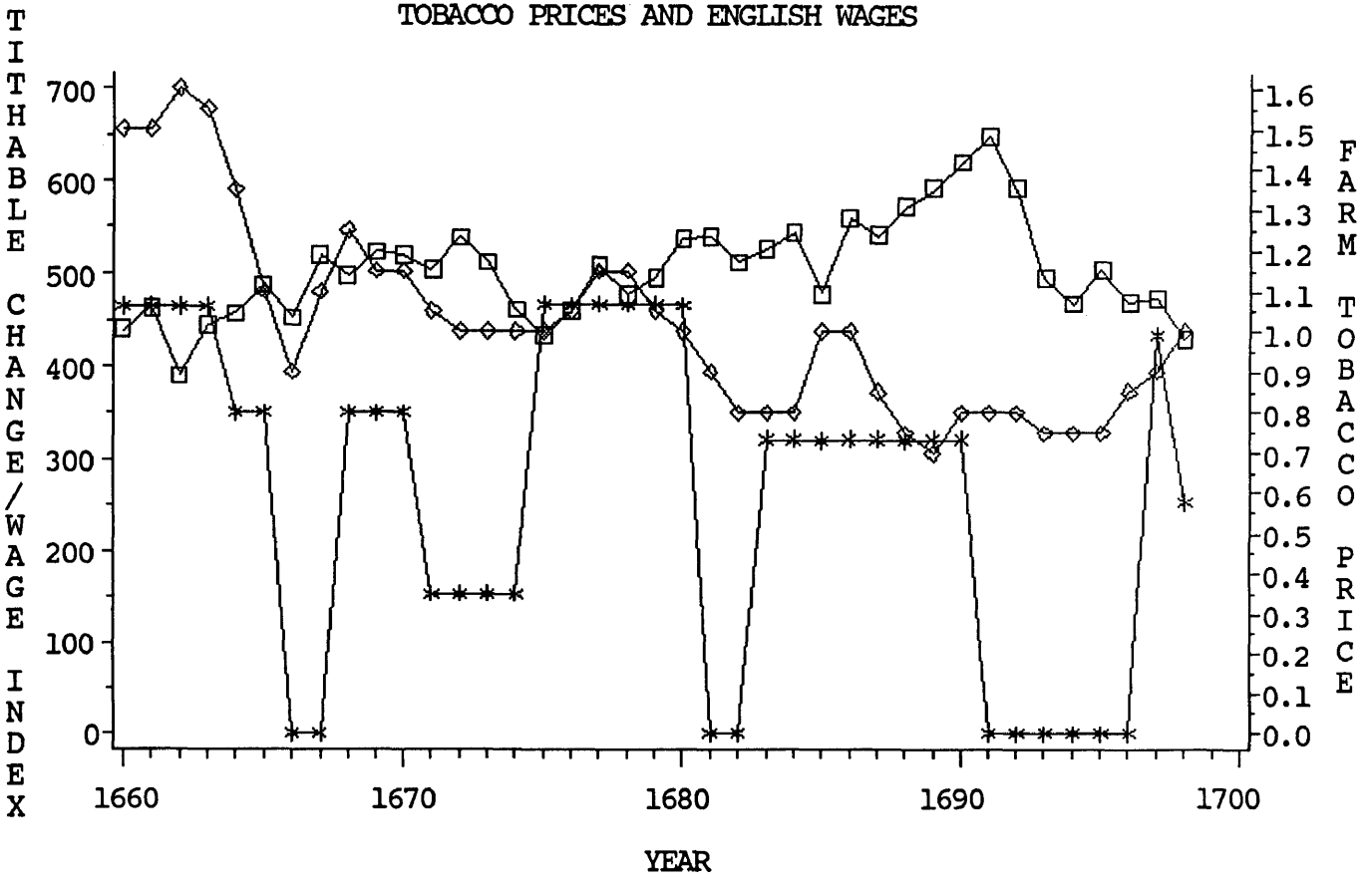
MODEL OF ANNUAL TITHABLE POPULATION CHANGE (DPOP)
IN THE COLONIAL CHESAPEAKE, 1664-1706

Model	Constant	WAGE-1	TOBO-0	TOBO-1	TOBO-2	YEAR	D.W.	R^2
1	-258.7	-2.36	1349*	-	-	26.3*	2.01	0.330
	(0.2)	(1.7)	(2.3)	-	-	(4.0)		
2	-276.0	-2.54	-	1383*	-	28.8*	1.97	0.372
	(0.3)	(2.0)	-	(2.8)	-	(4.4)		
3	661.8	-3.27*	-	-	836	26.6*	1.88	0.305
	(0.7)	(2.5)	-	-	(1.9)	(3.7)		

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses.

FIGURE IV
ANNUAL TITHABLE POPULATION CHANGE AS FUNCTION OF
TOBACCO PRICES AND ENGLISH WAGES



<STAR> ANNUAL CHANGES IN VIRGINIA TITHABLES POPULATION (DPOP)
<SQUARE> WRIGLEY-SCHOFIELD ENGLISH WAGE INDEX
<DIAMOND> NOMINAL FARM TOBACCO PRICES (PENCE STG PER LB TOBACCO)

English wage index and lagged tobacco prices varies with each model. The theoretically most believable model, Model 2, also has the highest R^2 and indicates statistical significance for both variables lagged one year. Further lags of tobacco price decrease the statistical significance of tobacco prices. This analysis indicates that "push" and "pull" factors were both important factors of population increase.

As with the land acquisition analysis, a Chow test[4] was run to test the contention that there was a different function for population increase in the first half (1664-1685) and the second half (1686-1706) of the time period under study. For all of the models in Table XV, there was no statistical difference between the two data sets at the 5% level of significance, thus rejecting the contention of a transformation.

Nominal Farm Tobacco Prices (TOBO)

Table XVI contains the results of the OLS regressions of lagged cumulative acreage (TACR) and population (POP) on TOBO. Based on F-statistics, all of the models show statistical significance at the 5% level of significance. The intercept is statistically significant and the time trends are statistically insignificant at the 5% level of significance. There is no significant difference between a three

[4] See fn. 2.

TABLE XVI

MODEL OF NOMINAL FARM TOBACCO PRICES (TOBO)
IN THE COLONIAL CHESAPEAKE, 1664-1706

Model	Const.	TACR-3	TACR-4	POP-1	WAGE-1	YEAR	D.W.	R^2
1	1.557*	-0.280*	-	-.0068	-	.0086	0.73*	0.454
	(5.3)	(2.4)	-	(0.4)	-	(0.9)		
2	1.511*	-	-0.257*	-.0081	-	.0085	0.71*	0.456
	(5.5)	-	(2.4)	(0.5)	-	(0.9)		
3	1.590*	-0.151	-	.0277	-0.0012*	-.0066	1.16*	0.572
	(6.0)	(1.3)	-	(1.5)	(3.2)	(0.7)		
4	1.550*	-	-0.139	.0255	-0.0012*	-.0058	1.16*	0.577
	(6.6)	-	(1.5)	(1.3)	(3.2)	(0.6)		

* denotes statistical significance at the 5% level of significance

Note: TACR-3 and TACR-4 in millions of acres
POP-1 in thousands of tithables
Absolute value of t-statistics are in parentheses.

or four year lag in cumulative patent acreage. However, all of the models suffer from strong autocorrelation.

The signs on the coefficients of cumulative acreage (TACR) are correctly negative, but the signs for cumulative population (POP) are correct only for Models 1 & 2. The coefficient on the English wage index is statistically significant but the sign is wrong since WAGE-1 is supposed to be an indicator of wage-induced demand for tobacco in England. If tobacco was wage inelastic, or the English tobacco demand was not a large part of the market, or the English wage index was not a good proxy for European wages, then we might expect this coefficient to be statistically insignificant. But this is not the case. The problem is believed to arise due to the strong effect of wages on immigration from England; lagged English wages are a much better indication of supply-side changes than demand-side changes. Thus, including WAGE-1 in the model obscures the effect of the other supply-side variables.

Either Model 1 or Model 2, then, is the preferred model, although both are rather poor. A Sargan's test[5] indicated there were model specification problems at the 5% level of significance so a modified model was tested which included, as independent variables, tobacco prices lagged by one year (TOBO-1), average lagged cumulative patent acreage (TACRA),

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[5] See fn. 1.

average lagged population (POPA) and a time trend (YEAR). After correcting this model for error specification problems, all of the coefficients were found to be insignificant.

Because using cumulative acreage and population might not capture the short-run fluctuations in supply-side changes, the model for tobacco prices was recalculated using annual patent acreage lagged three and four years (ACRE-3 and ACRE-4) and annual population changes lagged one year (DPOP-1) and the rsults reported in Table XVII. Based on F-statistics, all of the models show statistical significance at the 5% level of significance. All of the intercepts are statisticaly significant. The time trend is negative but statistically significant at the 5% level of significance only in Model 1. Unlike the cumulative totals, annual changes show a statistical improvement in increasing the lag from three to four years.

However, all of the signs are incorrect and all of the models still indicate strong autocorrelation. Inclusion of the English wage index has noticeably less effect with annual changes than with cumulative totals reflecting the annual nature of the index. In an attempt to salvage this model of tobacco prices, the same tests and corrections were run as previously done for the other tobacco price models, with similar negative results. The final corrected model had no significant coefficients. Further work on the 17th century tobacco market will be required in order to resolve the problems presented by these tobacco price models.

TABLE XVII

ALTERNATIVE MODEL OF NOMINAL FARM TOBACCO PRICES (TOBO) IN THE COLONIAL CHESAPEAKE, 1664-1706

Model	Const.	ACRE-3	ACRE-4	DPOP-1	WAGE-1	YEAR	D.W.	R^2
1	0.985*	0.993	-	.0091*	-	-.0058*	1.03*	0.490
	(12.3)	(1.5)	-	(2.5)	-	(2.7)		
2	0.908*	-	1.561*	.0098*	-	-.0041	1.09*	0.533
	(11.0)	-	(2.5)	(2.8)	-	(1.9)		
3	1.385*	1.043	-	.0710	-0.0008*	-.0039	1.25*	0.571
	(8.3)	(1.7)	-	(2.0)	(2.7)	(1.9)		
4	1.300*	-	1.535*	.0788*	-0.0008*	-.0024	1.34*	0.609
	(7.9)	-	(2.6)	(2.4)	(2.7)	(1.2)		

* denotes statistical significance at the 5% level of significance

Note: ACRE-3 and ACRE-4 in millions of acres
DPOP-1 in thousands of tithables
Absolute value of t-statistics are in parentheses.

CHAPTER VI

ALTERNATIVE MODELS

This study has not determined the exact role of fluctuations in the tobacco economy on growth and development of the colonial Chesapeake. Although rigorous hypothesis testing indicates that the importance of short-term fluctuations in tobacco prices has been over-emphasized, alternative models show significant effects of tobacco prices which at present cannot be explained. Table XVIII tests for the effect of various patent time lags and shows that with a four or five year time lag, tobacco prices had a significant effect on demand for land. Although there is no evidence that the patent process took anywhere near four years, decisions to patent land could have preceded formal patent application by several years and thus a patent lag of four years is not out of the question. However, the similarity of results for large patentees (who might have been more responsive to prices) and small patentees tends to make such time lags unlikely.

This analysis is confirmed by the sample of headright certificate totals from Accomack, Nortumberland, Lancaster and York counties, tested against the land demand model and presented in Table XIX. The similarity in the interweaving

TABLE XVIII

LAND ACQUISITION (ACRES) IN THE COLONIAL CHESAPEAKE WITH VARIOUS PATENT LAGS, 1664-1706

Lag (Years)	Constant	TOBO-L	TACR-L	POP-L	YEAR	D.W.	R^2
0	375166*	-45457	-0.113*	5.06	1032	1.86	0.648
	(3.4)	(1.5)	(3.5)	(1.7)	(0.5)		
1	382802*	-29869	-0.126*	5.08	1964	1.78	0.719
	(4.0)	(1.2)	(4.6)	(1.8)	(1.2)		
2	296054*	1413	-0.103*	3.44	1946	1.91	0.708
	(3.1)	(0.1)	(3.8)	(1.2)	(1.2)		
3	227121*	28121	-0.078*	0.56	2208	1.94	0.696
	(2.5)	(1.1)	(3.2)	(0.2)	(1.4)		
4	167239*	54916*	-0.054*	-2.98	2570	1.96	0.709
	(2.1)	(2.1)	(2.5)	(0.8)	(1.7)		
5	165359*	55252*	-0.045*	-5.69	3094*	1.81	0.710
	(2.1)	(2.1)	(2.2)	(1.3)	(2.1)		
6	299797*	-7752	-0.062*	-8.28	4016*	1.67*	0.606
	(3.5)	(0.3)	(2.8)	(1.5)	(2.4)		
7	451637*	-56905*	-0.081*	-13.7	5764*	1.61*	0.640
	(4.8)	(2.2)	(3.7)	(1.8)	(3.0)		
8	363049*	-60006*	-0.067*	-8.09	3635	1.60*	0.525
	(3.7)	(2.1)	(3.0)	(1.0)	(1.9)		
9	146959	3590	-0.037	-1.67	1527	1.46*	0.387
	(1.4)	(0.1)	(1.6)	(0.2)	(0.7)		

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses.

TABLE XIX

HEADRIGHTS (HEAD) IN THE COLONIAL CHESAPEAKE
WITH VARIOUS PATENT LAGS, 1664-1706

Lag (Years)	Const.	TOBO-L	TACR-L	POP-L	YEAR	D.W.	R^2
0	3977*	-553*	-1.25*	19.1	33.2*	2.48*	0.679
	(5.5)	(2.8)	(6.0)	(1.0)	(2.7)		
1	3600*	-431*	-1.20*	22.2	32.8*	2.48*	0.696
	(5.3)	(2.4)	(6.2)	(1.1)	(2.8)		
2	2247*	-53.8	-0.862*	22.3	22.8	2.36*	0.642
	(3.2)	(0.3)	(4.3)	(1.0)	(1.9)		
3	1118	322	-0.566*	12.7	17.6	2.46*	0.671
	(1.8)	(1.7)	(3.2)	(0.5)	(1.6)		
4	653	542*	-0.393*	-13.1	20.9*	2.47*	0.709
	(1.2)	(3.0)	(2.6)	(0.5)	(2.0)		
5	1432*	167	-0.546*	-17.4	27.0*	2.30*	0.639
	(2.4)	(0.8)	(3.4)	(0.5)	(2.4)		
6	2296*	-270	-0.727*	-16.1	31.7*	2.04	0.586
	(3.7)	(1.4)	(4.6)	(0.4)	(2.7)		
7	2361*	-139	-0.672*	-57.2	42.2*	1.17*	0.623
	(3.5)	(0.7)	(4.2)	(1.0)	(3.1)		
8	1302*	-35.4	-0.306*	-49.1	24.9*	1.90	0.560
	(3.0)	(0.3)	(3.1)	(1.4)	(2.9)		
9	708	52.3	-0.192*	-29.6	16.6*	2.13	0.435
	(1.9)	(0.5)	(2.2)	(0.9)	(2.1)		

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses.
TACR-L in thousands of acres
POP-L in thousands of tithables

Source: For headright certificates:
Accomack County (Nottingham, 1-64)
York County (Colonial Williamsburg abstracts)
Northumberland County (Virginia Colonial Abstracts, County Order Books #4 & #5)
Lancaster County (Virginia Colonial Abstracts, County Order Books #3, #3A & #4)

effect of density and tobacco prices with different time lags confirms the conclusions of Table VI that acquisition of headrights preceded land acquisition by 0-1 years. Thus demand for headrights either coincides with or slightly lags behind demand for land (if one accepts a 1-2 year delay in the land patent process).

A much better explanation of the lagged effect of tobacco prices on land acquisition would be that tobacco prices have a lagged effect on the factors which affect demand for land. Although regression analysis shows no statistically significant lagged relationship between tobacco prices and population density, perhaps tobacco prices affect other non-Malthusian factors of land demand. The lagged 4-5 year effect of tobacco prices on land acquisition could be seen as support for Clemens's hypothesis of a two-stage process of importing servants when tobacco prices were high and then acquiring additional land perhaps a couple of years later. Possibly the planter already had sufficient land from the previous cycle of servant importation and land acquisition to delay the acquisition of new land for 2-3 years.

However, other tests (presented below) show no such positive correlation between tobacco prices and servant importation. Using a model similar to that used to study population change (but with no time lags on the wage index), emigration from Bristol, England during the years 1654-1686 was found to be negatively correlated with lagged tobacco

prices, as shown in Table XX. This tends to support the conclusion of Lewis C. Gray, mentioned earlier, that planters were less concerned with making quick profits than with maintaining a certain income and they imported servants, not when tobacco prices were high, but when tobacco prices were low. This conclusion runs counter to the findings listed in Table XV for tithable population changes which were positively correlated with tobacco prices. As Menard found in his recent study of the Bristol emigration list, I also found a significant negative relationship between the English wage index and emigration (Menard,1988,108n). The relationship between immigration, tobacco prices, and English wages is shown in Figure V.

This negative relationship between tobacco prices and English emigration might be dismissed as coincidental, except that the same negative correlations may also be found upon examination of Chesapeake unindentured servant registrations. Menard and Walsh have found positive correlation with tobacco prices when examining individual counties (Menard,1973,326-8; 1977,363-5; 1988, 115-117; Walsh,1977, 26-27), but when all these servant registrations are examined in aggregate the results are quite different, as shown in Table XXI. In both Maryland and Virginia, masters were required to bring their unindentured servants (those who did not obtain indentures before leaving England) into the county court soon after acquiring them, and it was in the masters' best interest to

TABLE XX

MODEL OF BRISTOL EMIGRATION TO THE CHESAPEAKE (BRIS) AS FUNCTION OF LAGGED TOBACCO PRICES (TOBO-L), 1654-1686

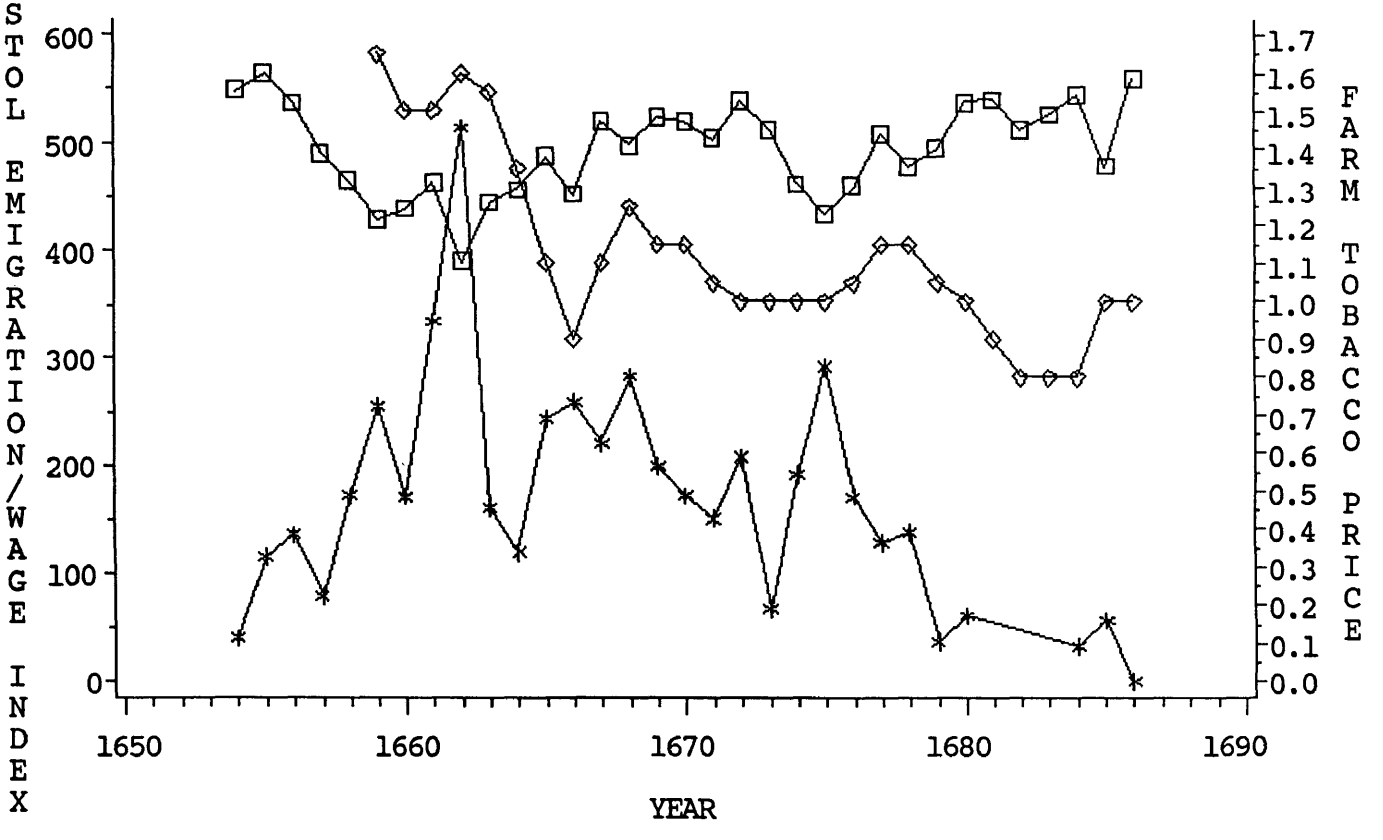
Lag (Years)	Constant	TOBO-L	WAGE	YEAR	D.W.	R^2
-1	10790*	-82.6	-1.27*	-5.92	1.72	0.503
	(2.1)	(1.3)	(3.3)	(2.0)		
0	16323*	-145.1*	-1.09*	-9.24*	1.93	0.594
	(3.5)	(2.8)	(3.2)	(3.3)		
1	20112*	-170.8*	-1.01*	-11.5*	2.28	0.645
	(4.3)	(3.6)	(3.2)	(4.1)		
2	21638*	-171.3*	-1.11*	-12.4*	2.42	0.642
	(4.2)	(3.5)	(3.6)	(4.0)		
3	21500*	-163.0*	-1.27*	-12.3*	2.00	0.626
	(4.0)	(3.3)	(4.2)	(3.8)		
4	15330*	-97.1	-1.44*	-8.57*	1.88	0.527
	(2.4)	(1.7)	(4.3)	(2.3)		

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses.

Source: Bristol emigration (A.E.Smith,309)
Tobacco prices (Menard,1973b,85)
English wage index (Wrigley,642-643)

FIGURE V
BRISTOL EMIGRATION TO THE CHESAPEAKE AS FUNCTION OF
TOBACCO PRICES AND ENGLISH WAGES



<STAR> BRISTOL EMIGRATION TO THE CHESAPEAKE
<SQUARE> WRIGLEY-SCHOFIELD ENGLISH WAGE INDEX
<DIAMOND> NOMINAL FARM TOBACCO PRICES (PENCE STG PER LB TOBACCO)

TABLE XXI

CHESAPEAKE SERVANT REGISTRATIONS (REGIS) AS FUNCTION OF LAGGED TOBACCO PRICE (TOBO-L), 1660-1706

Lag (Years)	Constant	TOBO-L	WAGE-1	YEAR	D.W.	R^2
0	-2251	41.2	-0.584*	1.53	1.25*	0.227
	(1.3)	(0.6)	(2.9)	(1.5)		
1	-1365	-12.7	-0.654*	1.06	1.31*	0.222
	(0.8)	(0.2)	(3.3)	(1.0)		
2	84.2	-75.2	-0.703*	0.253	1.39*	0.256
	(0.0)	(1.4)	(3.8)	(0.2)		
3	1127	-96.2*	-0.707*	0.350	1.45*	0.315
	(0.7)	(2.4)	(4.0)	(0.4)		
4	1409	-89.6*	-0.671*	0.531	1.44*	0.318
	(0.8)	(2.5)	(3.9)	(0.5)		
5	946	-65.4	-0.653*	0.276	1.45*	0.279
	(0.5)	(1.8)	(3.7)	(0.2)		

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses.

Source: Charles, Northumberland, Talbot, Somerset, and Prince George County registrations (Menard,1975,159)
York and Lancaster County registrations (Menard,1977,365)
Tobacco prices (Menard,1973b,85)
English wage index (Wrigley,642-643)

do so quickly to insure the maximum allowable term of indenture. Thus, a 0-1 year lag is probably the proper lag, but there are no independent estimates of this lag and longer lags are quite possible. If a 0-1 year lag is correct, then tobacco prices have an insignificant effect on servant registrations. But for longer lags, the tobacco prices have a significant and negative impact on servant registration. Servant registration correlates negatively with English wages regardless of the lag used, which supports the findings of Tables VI and XX.[1]

An alternative model for determining tobacco prices which shows great promise, although there is no theoretical basis to justify it, is simply a function of the Bristol emigration list totals to the Chesapeake (1654-1686) lagged by five years, as listed in Table XXII. The relationship is also pictured in Figure VI.[2] Along with a strong negative time trend, the negative correlation between this five-year lagged Bristol emigration and Chesapeake tobacco prices helps explain many of the fluctuations of tobacco prices in this time

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[1] Using a Chow test, the only model which shows significant difference between the first half of the period (1660-1685) and the second half (1686-1706) is the 0 year lag case in which tobacco prices are positive and significant only in the second half.

[2] Using Sargan's test, all except the five-year lagged model was shown to have model specification errors at the 5% level of significance. The autocorrelation of the five-year lag model was determined to be an error specification problem and an autoregression with a one year lag produced model 5AR1, also listed in Table XX.

TABLE XXII

NOMINAL FARM TOBACCO PRICE (TOBO) AS FUNCTION OF LAGGED BRISTOL EMIGRATION TO THE COLONIAL CHESAPEAKE (BRIS-L), 1654-1686

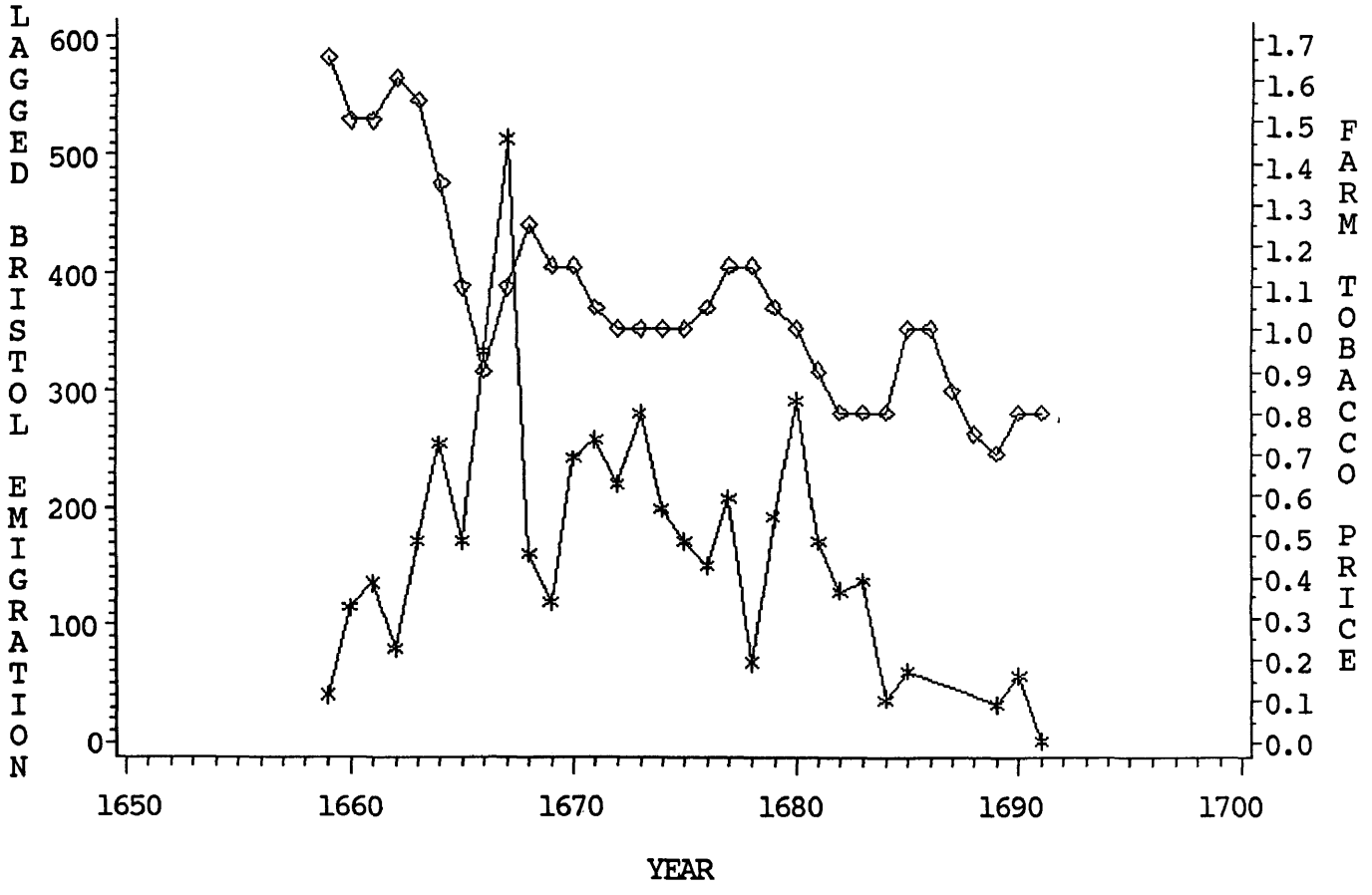
Lag (Years)	Constant	BRIS-L	YEAR	D.W.	R^2
0	84.18*	-1.67*	-0.049*	0.95*	0.784
	(10.1)	(3.9)	(9.9)		
1	70.37*	-1.09*	-0.041*	0.78*	0.716
	(8.4)	(2.5)	(8.2)		
2	64.77*	-0.79	-0.038*	0.81*	0.702
	(8.1)	(1.9)	(7.9)		
3	62.61*	-0.91*	-0.037*	0.85*	0.748
	(9.1)	(2.6)	(8.9)		
4	54.27*	-0.98*	-0.032*	0.82*	0.859
	(13.1)	(4.6)	(12.8)		
5	45.88*	-0.79*	-0.027*	1.44*	0.814
	(11.1)	(3.7)	(10.9)		
5AR1	44.19*	-0.54*	-0.026*	--	0.729
	(8.6)	(2.5)	(8.4)		
6	39.00	-0.59*	-0.023*	1.20*	0.728
	(8.7)	(2.5)	(8.5)		

* denotes statistical significance at the 5% level of significance

Note: Bristol headrights in thousands of headrights
Absolute value of t-statistics are in parentheses

Source: Tobacco prices (Menard,1973b,85)
Bristol emigration (A.E.Smith,309)

FIGURE VI
TOBACCO PRICES AS FUNCTION OF LAGGED CHESAPEAKE IMMIGRATION



<STAR> BRISTOL EMIGRATION TO THE CHESAPEAKE LAGGED BY FIVE YEARS
<DIAMOND> NOMINAL FARM TOBACCO PRICES (PENCE STG PER LB TOBACCO)

period. Interestingly, as might be expected from the positive correlation between population change and tobacco prices, this five year lagged Bristol emigration also shows a strong negative correlation with population changes, as shown in Table XXIII.

Although Bristol emigration could easily represent a proxy for all English emigration and this emigration may be a better proxy for supply changes than the population and acreage totals used above, why lagged by five years? One possible explanation is the normal four or five year term of indenture. Perhaps indentured servants did not reach their productive capacity until after they were freed and working for themselves, although there is no evidence to support such a conclusion. Perhaps indentured servants generally left the county upon gaining their freedom or else competition for land between freedmen and other farmers caused a general exodus from the county. The freedmen may have left the colony for good or otherwise avoided being recorded or for other reasons simply were not recorded on county tithable lists. Although all of this is pure conjecture and the relationship may be totally coincidental, the strength of the fit (especially in comparison to other tobacco price models tested) demands additional study of the relationship between immigration and the tobacco economy.

But if immigration to the Chesapeake is negatively correlated with tobacco prices, and immigration was the

TABLE XXIII

VIRGINIA TITHABLE POPULATION CHANGES (DPOP)
AS FUNCTION OF BRISTOL EMIGRATION
TO THE COLONIAL CHESAPEAKE (BRIS-L), 1654-1686

Lag (Years)	Constant	BRIS-L	YEAR	D.W.	R^2
0	6658	-112.8	-3.76	1.06*	0.041
	(1.1)	(0.4)	(1.1)		
1	7256	-35.0	-4.14	1.28*	0.054
	(1.2)	(0.1)	(1.1)		
2	8963	-21.1	-5.17	1.18*	0.068
	(1.4)	(0.1)	(1.3)		
3	7181	-39.5	-4.11	1.15*	0.049
	(1.1)	(0.1)	(1.1)		
4	10021	-580.6	-5.74	1.32*	0.138
	(1.6)	(1.8)	(1.6)		
5	13525*	-782.6*	-7.82*	1.52*	0.234
	(2.2)	(2.5)	(2.2)		
6	13893*	-577.5	-8.07*	1.35*	0.171
	(2.2)	(1.7)	(2.1)		

* denotes statistical significance at the 5% level of significance

Note: Bristol headrights in thousands of headrights.
Absolute value of t-statistics are in parentheses.

Source: Tithable population totals (Menard,1980,157-161)
Bristol emigration (A.E.Smith,309)

greatest source of population increase in the 17th century, why is there a strong positive correlation between population increase and tobacco prices? Indeed, as shown in Table XXIV, this strong positive correlation holds for the entire time period 1630-1730 although the relationship weakens significantly with time. (English wages only seem to be significant for the time period covered by the major part of this study.) Possibly the role of other components of population increase were more important than suspected. Most likely, people were less willing to emigrate from the colony when tobacco prices were high. Perhaps mortality was reduced when times were "good." This analysis certainly indicates the need to take a closer look at population changes in the 17th century on a local and colony-wide level.

TABLE XXIV

TITHABLE POPULATION CHANGE (DPOP) BY TIME PERIOD, 1630-1730

Time Period	Constant	TOBO-0	WAGE-1	YEAR	D.W.	R^2
1630-1730	-24284*	246.4*	0.580	14.34*	1.40*	0.309
	(4.7)	(3.6)	(0.6)	(4.5)		
1630-1660	-34995*	168.1*	-0.276	21.23*	0.95*	0.455
	(4.0)	(4.2)	(0.5)	(3.9)		
1660-1700	-20761*	712.7*	-1.479	12.55*	1.41*	0.385
	(2.6)	(2.7)	(1.9)	(2.8)		
1700-1730	-18170	552.7	2.625	9.90	1.53*	0.131
	(0.5)	(0.5)	(1.1)	(0.4)		

* denotes statistical significance at the 5% level of significance

Note: Absolute value of t-statistics are in parentheses.

Source: Tithable population totals (Menard,1980,157-161)
Tobacco prices (Menard,1973b,85)
English wage index (Wrigley,642-643)

CHAPTER VII

CONCLUSIONS

Land acquisition in the colonial era has been relatively ignored by economic and social historians. Land was simply abundant and was not the limiting factor of production in a perpetually labor-short colonial society. Colonists could go out and get land when they wanted it. But this abundance is deceiving because new land was made available to the people only by the slow, methodical process of patenting. And, as this study has tried to show, the decision to patent land was not taken lightly.

This thesis has shown the value of using social science theory to structure historical analysis. Theory organizes research agendas by identifying historical topics which need more research and by providing a formal basis to develop hypotheses which can be systematically tested. The great advantage of a study of land acqusition, to economists, demographers, and historians, is that it allows a chance to test social science theory much better than does most historical data. Land data is generally the best and most complete data from historical periods because of the ever-present concern over property rights. The ability to test such theories

should help us to develop an understanding of historical causation, of why things happened the way they did.

Also I have strived to show how comparative analysis with the work done on other regions and time periods (for this study, colonial New England and the antebellum North and South) also can benefit studies of the colonial Chesapeake. With further study, the trend might be reversed so that other regions could benefit from work on the colonial Chesapeake. A comparison between two closely related historical periods can offer great insights to both periods.

Comparative analysis especially offers much hope for explorations into the interrelationships between the colonial and antebellum South. The economic studies of land acqusition in the antebellum South should be re-examined with consideration of demographic factors. The two time periods should be treated as more continuous than discontinuous. Historians of both periods at least should no longer ignore the important work being done in the other.

There is little statistical evidence to support transformation theories in the late 17th century Chesapeake. Neither land acquisition, annual population changes, unindentured servant registrations, nor immigration showed any significant changes over the time period 1660-1706. However, there is some evidence of a "transformation" in the early 18th century provided by the study of annual population changes. Population change in the early 18th century became less

dependent on fluctuations in the tobacco economy and English wage conditions, which could possibly reflect the growth of importance of natural increase and/or the major shift to slave labor, as Kulikoff has suggested.

This thesis shows that the interrelationship between economic and demographic forces in the 17th century Chesapeake were indeed complex. Although the econometric analysis of land acquisition finds that the Malthusian hypothesis is superior to the staples thesis, the effect of short-term fluctuations in the tobacco economy cannot be ignored. The analysis of alternative models indicates that further work is necessary before there will be a clear explanation of the economic behavior of tobacco planters and merchants. Additional effort should be devoted to continuing the work of Yasuba, Forster and Tucker, Rutman, and Easterlin in identifying why population density is such a strong explanatory variable of early American economic and demographic development.

Perhaps lower tobacco prices caused small freeholders and landless tenants, men with small ties to the local economy, to migrate out of the colony, thus retarding population growth. But planters with great capital invested in the Chesapeake would have been unable to migrate and would even have been forced to import additional servants and slaves to maintain their cash flow, pay off their debts, and make up for the loss in the labor force due to out-migration. The

further study of the interrelationship between immigration to the Chesapeake and the tobacco economy offers great promise. It is possible that all of the ups and downs of the tobacco economy were driven by changes in the immigration flow which were totally independent of planter behavior, or perhaps even exacerbated by planter behavior (if planters brought over more servants when tobacco prices were low).

Perhaps the Malthusian and staples hypotheses represent merely two sides of a complex, multi-faceted theory of human behavior. The Malthusian theory could explain intra-colonial migration and the staples theory could explain inter-colonial migration. The staples model reflects differences in opportunity between the tobacco economy and other colonial economies; the Malthusian model reflects differences in opportunity within the tobacco economy. Migration between England and the colonies might be explained by a combination of the two theories, since the colonies were both a part of and separate from the English economy.

Neither theory is complete in and of itself. Although Malthusian theory might predict the level of land acquisition or intra-colonial migration, this theory tells us little about the direction of that acquisition or migration in the colonial Chesapeake. For the staples theory, 17th century planters often did not respond as quickly or in the way that staples theory would predict. With more studies such as this, it may be possible for a more generalized theory to be developed

which subsumes both the Malthusian and staples hypotheses, combines equally economic and demographic factors, and explains both individual and aggregate behavior.

APPENDIX I

NAMECODING SYSTEM AND ANALYSIS

Because of the vagaries of 17th century English orthography and the peculiarities of 17th century English surnames, any computer data base analysis of individual land acquisition must include some sort of namecoding system. In trying to match individuals between two different records (for example, patent and patent or rent roll and patent), I wanted to be sure that I did not miss possible individual matches yet, at the same time, it would have been too costly to go through all possible matches by hand to ensure that the matches were realistic.

If the data base is small enough, one simply could simply standardize the spelling of each name when entered. However, when the data base gets rather large, this practice becomes inefficient and impractical. Also, for the 17th century, I would be very hard pressed to determine the standard spelling of any surname due to the wide variety of surnames which are very uncommon in the modern United States.

The most common method of standardizing names is to use a coding system which reduces names to an alphanumeric code based on similar sounds of various letters or combinations of

letters. The most often used coding system is the Soundex system developed for genealogical tracing of individuals in the 1880, 1900, and 1910 censuses. In the Soundex system, "the surname is indexed by using the initial letter; the letter is followed by three numerical digits based on the consonants that follow the surname initial. Consonants that sound somewhat alike, though widely separated in the alphabet, are drawn together under one numeric code." The consonant groupings are: b,p,f,v; c,s,k,g,j,q,x,z; d,t; l; m,n; r. Vowels, unless initial, are not coded (Helmbold 54-55). Bouchard and Pouyez present an interesting description of alternative namecoding systems developed for French Quebec names (119-125).

Although I could have used the Soundex system as is, I found that it was both too much and too little. At least for 17th century English surnames, the Soundex too often combined unsimilar names and missed similar names. The major problems were the loss of information with vowel elimination and the peculiar pronunciation of various consonant-consonant and vowel-consonant combinations in 17th century English speech.

Like the Soundex, I realized that the key to a good namecoding system was to envision each surname as code representing a combination of sounds. The written name, especially in the 17th century, is merely an approximation of an oral name and it is the oral name we need to try to recreate. Dictionaries of English pronunciation (Noory;

Wright) were examined to identify problematic consonant and vowel sound groupings. Various 16th and 17th century English spelling-books (Fox and Hookes; Price; Bullokar) were studied to determine both 17th century "standard" English spelling and pronunciation and typical English spelling problems.

The most troublesome problem was consonants which changed their sound in various vowel-consonant and consonant-consonant combinations. This includes the standard English "soft" and "hard" consonants like "c","g", and "ch" but also some non-standard English variable-sound consonants. For anyone familiar with traditional southern speech, 17th century English pronunciation is not totally foreign. The most notorious consonant is "r" which is sometimes pronouced (after consonants and before vowels) and sometimes is not (before consonants and after vowels). The "r" also tends to convert all preceding vowels into a schwa. Similar problems arise for other consonants like "l", "m", and "n" in various combinations with other consonants and vowels.

In studying English names, it was clearly obvious that the only important distinguishing vowel sounds were the initial vowel sound and a final, ending vowel sound (if the name ended in a vowel sound, such as BIGELOW). The prototype namecoding system included a vowel conversion routine which converted vowels in various vowel-vowel and vowel-consonant combinations to standard vowel sounds:

A = long A

E = short A,E,I,Y

I = long E

O = schwa, long O, short O,U

U = long U

Y = long I,Y

However, after various tests, this vowel conversion routine was found to create as many problems as it solved. In reality, there is too much variety in spellings of various vowel sounds, and too much overlap in vowel sound groupings. Thus, in my final namecoding system I settled on two vowel sounds "E" (for long and short A,E,I & Y) and "O" (for schwa, long and short O & U). I could have eliminated all vowel sounds like the Soundex, but the two-vowel system was found to be superior for reducing the number of misgroupings. Also more efficient than simply eliminating the vowel sound is to at least mark the location of the initial vowel sound to distinguish between such common initial consonant-vowel combinations as "BAL" and "BLA". All final, ending vowel sounds were simply reduced to "O".

My namecoding system, similar to the soundex, reduces consonants sounds down to numeric representation:

1 = B,P,F,V

2 = S,Z

3 = K,G,Q

4 = D,T

5 = L

6 = M,N

7 = R

8 = W

9 = H

Particular attention was paid to defining the "R","W", and "H" sounds.

After deriving the basic formula, the namecoding routine was tested using various lists of problematic colonial Virginia and English surnames (Green; Hall; Bardsley; Ewer) and then fine tuned. As an example, after running through this namecoding routine, the name "MOUNTFORD" is converted to "MO614". The initial consonant is maintained; the vowel "OU" is reduced to "O"; the consonant combination "NTF" is reduced to "61" due to the tendency in the 17th English language to drop the middle consonant in a three-consonant combination headed by "M" or "N"; the second vowel sound is dropped; and the final "RD" is converted to "4" due to the tendency for "R" after a vowel and before a consonant to blend into the final consonant. (This explanation is just a simplification of these conversions which occur in the namecoding routine, but give the basic gist.) In a similar way, the names "MANFORD," "MOMFORD," "MONTFORT," "MOUNFORD," "MOUNTFORT," "MUMFORD," "MUMFORT," "MUMFORT," "MUMPFORD," and "MUNFORD," all of which appear in the patent records, are likewise reduced to "MO614". This agrees with B.W. Green's statement that the Virginia

names spelled Montford or Munford was actually pronounced Mumford (15).

Finally, all of the available surnames in the patent records from 1660-1706 were converted and the surname groupings analyzed for irregularities. These irregularities were then corrected using separate cross-reference tables for both names and codes. All given names and abbreviations of given names were standardized using a cross-reference table. For certain unusual given names, the patent records were searched to see if there were transcription or spelling errors. For all matching analysis, because of the uncertainty associated with surnames, it was absolutely critical to have standardized given names. The matches described in this report all required an exact match of both the given name and namecode (and sometimes county, date, or acreage). This double or triple matching eliminated most spurious matches since most given name-namecode combinations in 17th century Virginia were still rather unique due to the immigrant source and smallness of the population.

In practice, two different coding systems were developed, one for headright analysis and another for landowner analysis. The namecoding system described above was used for landowner analysis but a simplified, more generalized code was required for headright analysis due to greater variation in spelling of headright names. This was especially necessary for analysis of headrights who later became landowners to avoid

missing a possible match. In this simplified code all vowels in the code were reduced to "E" and certain troublesome consonants ("W","H", final "S", final "R") were eliminated. Because this simplified code had a tendency to overmatch (to match unrelated names), this required a follow-up hand search through the derived name matches to eliminate unreasonable matches.

For the analysis of headright abuse of individual headrights, sensitivities were run eliminating namecodes of less than 3 or 4 characters (which were more likely to combine unrelated names), common namecodes like "S6E4" (Smith) and "B7E6" (Brown), and the most common given names (John, William, Thomas, Robert, Richard, Mary). The percentages were then prorated based on the size of the sample.

For the analysis of serial abuse in headrights, a headright was paired with the preceding headright (in the list contained within the patent) and then the paired headrights matched with similar paired headrights. Thus "Anne Green, Thomas Bowen" in one patent might be matched with "Ann Growen, Thom. Boon" in another patent. Each headright list was then examined for pattern of such matches, taking into account spelling or transcriptions errors (which were rampant in the headright lists) which might intermittently break the serial pattern.

APPENDIX II

ECONOMETRIC ANALYSIS

This thesis employs multiple regression analysis described in any standard statistics textbook (e.g., Maddala). All models are expressed in the form of the algebraic equation:

$$Y = a0 + a1*X1 + a2*X2 + \ldots + an*Xn + u$$

where,

Y is the dependent variable (variable to be explained) on the left-hand side of the equation

X1,...,Xn are the independent or explanatory variables on the right-hand side of the equation

a0 is a constant coefficient (similar to the y-intercept in a simple algebraic equation)

a1,...,an are the coefficients of the independent variables

u is the error term

Multiple regression analysis determines the coefficients a0,...,an which provide the "best fit" upon inserting sets of data into the equations. Since the data involved in this

analysis is annual time series data, the "set of data" is that unique combination of dependent and independent variables which occur in any particular year, say 1696. However, when a lagged effect occurs, say when tobacco prices in 1696 affect land patent acquisition in 1698, then lagged independent variables are used, represented in the form Xn-L where L is the number of years of lag. Thus, tobacco prices in 1696 lagged by two years (TOBO-2) are treated as if they were tobacco prices in 1698.

Since the calculated set of coefficients a0,...,an is only a "best fit," any particular set of data will rarely fit the equation perfectly so an error term u, which can be either positive or negative and differs for each set of data, is included in the equation.

The tables of multiple regression results list the values of the calculated coefficients a0,...,an, and list the t-statistics in parentheses underneath each coefficient. A t-statistic is the measure of confidence that the listed coefficient is not merely random (i.e., is significantly different than zero), and is calculated by dividing the coefficient by the standard deviation of the coefficient. For most analyses presented here, t-statistics of 2 or greater indicate that there is statistically less than a 5% chance that the coefficient is purely random. Lower t-statistics indicate a much greater chance of randomness and 5% is considered by most econometricians the maximum degree of

chance acceptable when assessing statistical significance. Coefficients that have less than a 5% chance of being random and are thus statistically significant at the 5% level of significance are specially indicated by an *. T-statistics are listed as absolute values (without + or - signs) simply for ease of reading, because the t-statistic will always have the same sign as the coefficient.

A measure commonly presented in econometric analyses is the R^2 statistic, which is a measure of the fraction of variation in the dependent variable that is explained by the "best fit" equation. Normally the higher the R^2 the better the model, but the R^2 statistic can be quite deceiving and is not a proper statistic for judging the statistical significance of a model because it heavily dependent on the type of model and data being tested. A model which uses a lot of individual level data and has an R^2 of 0.15 may be much better than a model which uses aggregated data and has an R^2 of 0.90. However, when comparing two similar models using the same data, R^2 provides a quick check of which is the better model.

Because we are dealing with time series data which often tends to be cyclical in nature, one of the most important statistics in every table presented is the Durbin-Watson or D.W. statistic. A major assumption of multiple regression analysis is that the error term (u) for any set of data should be random. For annual time series data, however, this year's error term is often related to last year's error term. For

example, if last year's prediction was high, then this year's prediction might tend to be high. If the model tends to overpredict for a few years and then underpredict for a few years, this is called positive autocorrelation which is the most common problem in normal time series data. (If the model bounces back and forth every year between overprediction and underprediction, this is called negative autocorrelation which is much less common.) Often the problem occurs because the independent variable cycles continually lag behind or lead the dependent variable cycles and so the cycles never synchronize. Autocorrelation could be due to problems either with the model (model specification error) or with the data (error specification error) and there are statistical ways to test for this, such as Sargan's test (Maddala 210). For most of the models presented here, the model is the problem. When dealing with lagged effects, the most likely cause of model error leading to autocorrelation is choosing the wrong lag time.

The Durbin-Watson coefficient is a measure of autocorrelation on a scale of 0 to 4 with 0 (perfect positive autocorrelation), 2 (no autocorrelation) and 4 (perfect negative autocorrelation). As with t-statistics, we are interested in when the odds of autocorrelation being problematic have less than a 5% chance of being random. This depends heavily on the length of the time series and the number of independent variables in the model. For the models and data examined in this paper, positive autocorrelation generally

becomes problematic when the Durbin- Watson statistic falls below about 1.6.

Other statistical techniques are discussed in the appropriate footnotes.

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