TESTING FOR CHANGES IN THE EFFECTS OF GOVERNMENT PAYMENTS ON FARMLAND VALUES IN ONTARIO

by

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I. Introduction

Farmland values across North America have increased significantly over time, and in particular since the mid-1980s. Over this period of time, while there have been some productivity increases, commodity prices have not increased, thus total returns have not experienced a significant increase that would seem necessary to support escalating land prices. Farmland values have continued to increase in the face of decreasing net farm incomes. Even with negative net farm incomes reported in several provinces in recent years, land values have continued their ascent.

Supply and demand forces have played a role in this trend. Faced with shrinking margins and incomes, producers are pressured to increase the size of the farming operation in order to maintain a viable operation. This has led to increased demand for land, and with a relatively fixed supply of land, prices have spiraled upward.

There are other factors that may have contributed to the rising farmland values. Farm returns are not only restricted to returns from agricultural production. Producers in North America are often recipients of payments through government support programs. These programs are often put into place to provide price, production, or income support for farmers to protect them from the significant level of risk that exists with production of agricultural commodities. The primary objectives of such programs are generally to provide payments that compensate farmers for lost income. However, these payments may also be capitalized into the value of assets such as land, which forces asset prices higher. If producers are using government payments to pay higher prices for land, this
implies that these programs are not fully meeting their objectives. Additionally, the increasing asset prices could, in turn, lead to more demand for government payments to compensate for reduced income.

There have been a number of studies undertaken to address this issue. Weersink et al. (1999) found that land values in Ontario are more responsive to government payments than to market returns. Roberts, Kirwan, and Hopkins (2003) found an incidence of government payments on land rents in the U.S. of between 34 and 41 cents for each dollar of payments. Shaik, Helmers, and Atwood (2005) also found a significant positive relationship between government payments and land values in the U.S. However, their results indicated that the share of land values generated by government payments has decreased in recent years. During the 1960’s and 1970’s, this share was as high as 40%, but since 1990, the share has dropped to between 15% and 20%.

The decline in the share of land values generated by government payments, as suggested by Shaik, Helmers, and Atwood, has coincided with a shift in government programs from coupled programs to decoupled programs. Programs are considered to be “coupled” if their benefits are directly related to production. Such programs can significantly influence farmers’ production decisions. For example, a price support program that compensates farmers for low commodity prices will influence their production decisions if the level of payments received is based on their current production. Alternatively, if the program payments are based on historical production, their influence on production decisions is minimal. Such programs are considered to be “decoupled”. Although program payments
increase total farm revenue, they do not increase per-unit net returns of specific production alternatives, and thus do not offer incentive to increase production of one commodity over another.

In the U.S., the 1996 Federal Agriculture Improvement and Reform (FAIR) Act implemented policy changes in an attempt to shift from coupled programs to programs that would be less production and market distorting. Payments under these programs were based on historical acreages and yields for each producer, thus decoupling payments from current production decisions. This shift to decoupled programs occurred in part in response to the WTO negotiations, which stipulated that government support programs must fall within the Green Box category, whereby program payments should not affect production or trade.

This shift has occurred in Canada as well, although in Canada it could be argued that the current programs are only partially decoupled. Recent programs such as the Net Income Stabilization Account (NISA) program and the Canadian Agricultural Income Stabilization (CAIS) program focus on income support instead of price support and on whole farm coverage instead of commodity specific coverage. While these programs are no longer coupled to production decisions regarding specific commodities, they cannot be considered fully decoupled since compensation is still determined based on current production. However, this shift away from coupled programs may affect the impact that program payments have on farmland values.
The objectives of this study are to evaluate the impacts of government payments on farmland values in Ontario, and to determine whether there has been a decline in the relative effects of these payments on land values in recent years. A decline in the rate of capitalization of payments into land values could imply that current government programs are not having as much of a distorting effect on land values, and that these programs may be more successful in achieving their objectives.

It is important for governments to have knowledge regarding the potential impacts of program payments. Measuring the impact of these payments may allow governments to observe how closely these impacts are aligned with the objectives of their programs. Though the primary objective of government programs is to enhance farm income, economists have recognized that the payments from these programs tend to increase farmland values. Awareness of these impacts may affect future program design and objectives. Thus, policy makers could benefit from any knowledge regarding changes in the rate of capitalization of program payments into farmland values.

The next section reviews the general approach to valuating assets and discusses a number of studies that have used, extended, or revised this approach. Results of previous studies are also discussed in this section. In the following section, an empirical framework is developed for estimating the effects of government payments over time on land values in Ontario. An overview of the empirical results is also provided. The final section offers some conclusions and suggestions for further research.
II. Conceptual Framework

Factors that play a role in determining farmland values have been studied for many years. Some early studies reached a number of different conclusions regarding the determinants of land values and the factors that have caused changes in these values over time. Tweeten and Martin (1966) found the determinants included farm expansion pressures and capitalized government payments. Reynolds and Timmons (1969) found that land prices were determined by expected capital gains, government payments, farm enlargement, and the return on common stock. Klinefelter (1973) found that changes in land prices were explained by net returns, average farm size, number of transfers, and expected capital gains. Castle and Hoch (1982) found that land prices were determined by expected capitalized rent and expected capital gains.

The general approach to pricing assets such as farmland has been through the present value model, which involves the determination of a net present value (NPV) of the asset. This model has been used in number of studies to assess the determinants of land values. Burt (1986) and Alston (1986) were among the first to use this capitalization model in the context of farmland values. Others have followed, incorporating minor changes to the basic model.

The NPV is calculated by estimating the future stream of cash flows resulting from ownership of the asset, and discounting these cash flows based on the level of uncertainty inherent in the expected returns. The capitalization model is derived through this approach, summarized by the following equation:
where \( V_t \) is the value of the asset, \( R_t \) is the real return from the asset based on expectations in period \( t \) (\( E_t \)), and \( r_t \) is the real discount rate, which varies over time. This equation can be further simplified, through the assumptions of a constant discount rate (\( r \)) and constant returns (\( \overline{R} \)), to the traditional capitalization model:

\[
V_t = \frac{\overline{R}}{r} \tag{2}
\]

This equation has formed the basis for many studies on asset values, and has been incorporated into studies on farmland values.

The issue of the impact of farm policy on land values has been the subject of a number of studies in recent years. Most studies on the effects of government payments on farmland values attempt to measure this impact directly, usually through the capitalization model, where land values are determined primarily through expected future cash flows from the land (Weersink et al., 1999). This model is derived from the capitalization model given in equation (1), and can be summarized as follows:

\[
L_t = \sum_{j=1}^{\infty} b^j E_t R_{t+j} \tag{3}
\]

where \( L_t \) is the value of land, \( R_t \) is the rent from land at time \( t \), \( E_t \) is the expectations operator, and \( b \) is the discount rate, such that \( b = 1/(1+r) \).

To account for returns from both production (\( P \)) and from government payments (\( G \)), Weersink et al. (1999) expanded this model into the following equation:
\[ L_t = \sum_{j=1}^{\infty} (b_{1j} E_t P_{t+j} + b_{2j} E_t G_{t+j}) \]  

(4)

where \( b_1 \) and \( b_2 \) are the time-varying discount rates of \( P \) and \( G \), respectively.

The value of land is thus calculated as the present value of the expected future returns, discounted based on the risk of income from each source. The discount rates from each source are allowed to differ to reflect varying levels of uncertainty associated with returns from the different sources of future returns. The discount rate for each source also varies over time. However, if the discount rate for each source is assumed to be constant over time, then equation (4) can be simplified to:

\[ L_t = \beta_1 E_t P_{t+1} + \beta_2 E_t G_{t+1} \]  

(5)

where \( \beta_1 \) and \( \beta_2 \) are the respective constant discount rates for expected cash flows from production and government payments. This equation constitutes the general form for models that have previously been used for agricultural asset value determination.

Empirical studies on the effect of government payments on land values have involved a number of different approaches, and have had mixed results. Moss, Shonkwiler, and Reynolds (1989) used a vector autoregression framework to determine the relationship between farm asset values and government payments. Farm income was split into two components, market income and government payments, and the effects of each source of income on real asset values were tested. The impulse response functions generated by their model indicated that while increases in market income were quickly capitalized into asset values, the same did not hold true for government payments. In fact, the authors found that in the long run, increases in payments had little effect on asset values.
Goodwin and Ortalo-Magne (1992) attempted to evaluate the impact of agricultural policy reform on farmland prices. In this study, the authors used a variation on the general approach to valuing farmland, using an approach where land prices are a function of expectations of government support, farm prices, and yields. The results of this study indicated that a 1% change in government support payments would result in a 0.38% change in land prices. Returns to land through government payments were discounted significantly compared to returns based on prices and yields. This may be a result of uncertainty with respect to future government support payments.

Clark, Klein, and Thompson (1993) used the PVM approach to determine whether government payments were capitalized into Saskatchewan land values. In their present value model, land values are based on discounted expected future returns to land, which is composed of revenue from production and subsidies. The authors suggested that land values series and returns series were correlated and that each contained a unit root. They used both the Dickey-Fuller and the Kwiatkowski tests to test for the presence of unit roots, with both tests confirming the existence of a unit root for the land values series and for the income plus subsidies series. Some evidence was found that land values and income plus subsidies were cointegrated. The results of the model provided some indication that short-run subsidies were capitalized into land values.

Barnard et al. (1997) measured the extent to which government payments are capitalized into U.S. land values. This study utilized micro level data from regions all across the U.S.
The results indicated significant spatial variability in the rate of capitalization of
government payments. While the highest degree of capitalization of government
payments was 50%, many areas had capitalization rates of 10-20%. The results also
indicated that elimination of government payments would reduce land values from
between 12% and 69%.

Weersink et al. (1999) estimated the separate effects of market returns and government
payments on farmland values in Ontario and examined the discount rates associated with
each source of income. Using Non-linear Seemingly Unrelated Regression, the authors
found that returns from government payments were discounted less than returns from
production, contrary to what was hypothesized. This implied that government payments
had been a more stable source of income. The elasticity of land values with respect to
government payments was significantly higher than that of market returns, implying that
land values are more responsive to government payments.

Goodwin, Mishra, and Ortalo-Magne (2003) took the standard approach, as described in
equation (4), one step further. Instead of combining all government payments into one
variable, they differentiated between four types of programs. This was done to account
for the varying uncertainty about the future of each type of program and the expected
future payments from each type of program. The results confirmed the hypothesis that
different programs have different effects on land values. While payments under most
types of programs had significantly positive impacts on land values, these effects varied
across year, crop, and region.
Instead of focusing on the relationship between government payments and land values, Roberts, Kirwan, and Hopkins (2003) focused on the relationship between payments and cash rents. This prevented any non-agricultural influences that affect land values from factoring into the determination of land rents. The strongest estimates derived from this analysis implied an incidence of government payments on land rents of between 34 and 41 cents for each dollar of payments.

Barnard et al. (2001) used cross-sectional data to analyze farmland values in the regions of the U.S. which received the largest amount of program payments. This analysis was used to estimate the percentage of the total farmland value within each region that was attributable to government payments. The results of this study indicated that program payments had the greatest impact on land values in the Heartland, where payments accounted for 24% of farmland value. Similar effects were found in the Prairie Gateway region (23%) and the Northern Great Plains (22%).

Other studies have indicated different results. Gardner (2003), following the approach of Barnard et al., used data from 315 counties across the US to estimate the impact of government payments on land values. Recognizing the limitations inherent in using a cross-sectional approach, he incorporated a time series element. He found that there was only weak evidence to support the claim that government payments have caused a significant increase in land prices.
Similarly, Just and Miranowski (1993) found that government payments are only a minor factor in the determination of land prices, and that changes in government payments would often only offset changes in market returns. While government payments accounted for between 15 to 25% of the capitalized value of land, they only accounted for a very small part of land price fluctuations. Results of this study suggest that inflation and the opportunity cost of capital play an important role in causing changes in land prices.

Controversy exists regarding the validity of present value models for assets such as farmland. A number of authors have pointed out inconsistencies and problems related to the use of the PVM for assessing the determinants of land values.

Featherstone and Baker (1987) pointed out that many of the early studies on land values used static models, which assume that prices instantly adjust to a long run equilibrium. They attempted to account for this limitation by looking at the time path of adjustment for variables such as returns and interest rates. To conduct this study, a vector autoregression system of equations was used, where all variables are treated as endogenous, as each variable in the system impacts all other variables through lagged effects. The authors found that net rents cannot explain all of land price changes, as speculative forces may also play a role in land price determination. They concluded that the response of land prices to changes in expected future returns is too large and drawn out to be consistent with the present value model.
Campbell and Shiller (1987) used a cointegrated vector autoregression (VAR) model to address the problem of non-stationarity in time series that often occurs with the PVM. They developed a test of the present value model that is valid when the variables are stationary. The authors derive a method of assessing the significance of deviations from the present value model by comparing the forecast of the present value of future returns with an unrestricted VAR forecast. A new variable is defined called the “spread” – the difference between the price of the asset and the return on asset, such that:

$$S_t = Y_t - \theta y_t,$$

where $S_t$ is the spread, $Y_t$ is the price of the asset in period $t$, and $y_t$ is the return on the asset in period $t$.

The use of this equation helps resolve the stationarity issue, for if $\Delta y_t$ is stationary, then $S_t$ will be stationary, which implies that $\Delta Y_t$ is also stationary. The VAR framework can be used to conduct statistical test of the present value model and also to evaluate its failures. If the present value model is valid, differences between the spread $S_t$ and the theoretical spread $S'_t$ should only be due to sampling error. Large differences imply economically significant deviations from the model.

There are two approaches that can be used to account for non-stationarity. In one approach, the series is assumed to be stationary around a linear trend. Another approach is to assume that the process is difference stationary, where the first differences of the process form a stationary process. One important difference between the two is that an unexpected change in the trend stationary approach has only a temporary effect on the
Using time series data from Iowa, Falk (1991) found evidence for a difference stationary process for net rents and land prices. He first tested whether land prices and rents were difference stationary as opposed to trend stationary. Dickey-Fuller test results indicated that the null hypothesis of difference stationarity could not be rejected. He then tested the restrictions that the PVM imposes on the VAR representation of the change in net rents and the spread. Because restrictions were rejected, the validity of the PVM could not be supported. Though correlation existed between land prices and rents, changes in land prices were much more volatile than changes in rents. Falk suggested that the failure of the model may be due to the presence of asset bubbles, often a result of self-fulfilling beliefs regarding future movements in values.

Goodwin, Mishra, and Ortalo-Magne (2003) pointed out that empirical models based on the PVM possess a fundamental limitation. Land values are determined based on expectations of future returns from production and from government payments; however, these expected future cash flows cannot be observed. While these expectations should be fairly stable for a given location and policy set, actual returns from both production and government programs tend to be quite variable. Thus, observations from a particular year may not be an appropriate indicator of the level of returns that can be expected in the future. The use of such observations may result in an inaccurate depiction of the
magnitude of land value determinants. However, an alternative methodology was not proposed to avoid this limitation.

Goodwin, Mishra, and Ortalo-Magne also identified problems that complicate empirical analysis when government payments are incorporated into the model. By considering government payments as an explanatory variable separate from market returns, there could be the problem of multiple variables observed with error. When observing payments from multiple programs, these errors could be correlated. With realized returns from government programs highly variable, there may be significant differences in the effects of policies from year to year.

Roberts, Kirwan, and Hopkins (2003) identified other issues associated with the use of both government payments and market returns as explanatory variables. These variables tend to be highly variable relative to land values. In addition, government payments and market returns tend to be negatively correlated. In years when market returns are low, government payments will generally increase as a result. Conversely, high market returns tend to reduce the need for government payments.

The counter-cyclical nature of government payments was addressed in a study by Shaik, Helmers, and Atwood (2005). While both expected crop returns and expected government payments were hypothesized to be positively related to land values, the inverse short-run relationship that often exists between these two variables could potentially cause an identification issue. In an attempt to overcome this issue, the authors
used a simultaneous equation model, comprised of two equations. The first equation estimated land values as a function of crop returns, government payments, and other factors. The second equation estimated government payments as a function of crop returns, the current Farm Bill, and other factors. The joint estimation of these two equations helped to overcome the identification issue. The authors suggested that this type of model could provide a more accurate estimation of the capitalization model.

While results from the traditional single equation model indicated a negative relationship between government payments and land values, the use of the simultaneous equation capitalization model resulted in significant positive relationships between U.S. land values and both crop returns and government payments. These results also suggested that land values were more responsive to crop returns than to government payments.

Shaik, Helmers, and Atwood also estimated elasticities of the crops return and government payment variables from the simultaneous equation model in order to estimate the share of land values generated by crop returns and by government payments. They tested for changes in these shares over time, with the time periods corresponding to specific farm bills that were in effect in the U.S. The authors found that the share of land values generated by government payments was as much as 40% before 1980. However, since 1990, this share has declined to between 15% and 20%. This suggests that the rate of capitalization of government payments into land values has decreased in recent years.
Overall, the literature does not present conclusive evidence as to the most accurate method for determining farmland values. There is no way to avoid the issue of using unobservable data, as this is necessary to ascertain expected future cash flows. The use of the present value model may be questioned unless steps are taken to account for issues such as non-stationarity. In addition, the inverse relationship between market returns and government payments may affect the significance of the impacts of these variables on land values. This study takes these issues into consideration in the development of a model for the purpose of evaluating the determinants of agricultural land values.

III. Data Description and Empirical Analysis

This study used provincial level data from 1947 to 2004 for land prices, net farm income, government payments, and interest rates. Data was obtained from Statistics Canada’s CANSIM database, catalogue #21-013 for land prices per acre, catalogue #21-010 for net farm income, and catalogue #21-011 (farm cash receipts) for government payments. Government payments were removed from net farm income to avoid double-counting of this revenue. Net farm income was further adjusted by removing land rent expenses, as these expenses are not relevant when considering returns to land, and by removing depreciation expenses, to remove the effects of non-cash expenses. Land prices, adjusted net farm income, and government payments were deflated by the GDP annual index (1997 = 100). A real interest rate was also calculated, by adjusting the chartered bank prime business rate (CANSIM Table 176-0043) for inflation as measured through the GDP index.
The approach for this study begins by examining the determinants of land values in the province of Ontario. Specifically, the effects of net farm income and government payments on farmland values are estimated and compared. The data is then tested for changes in the effects of government payments on land values over time.

Non-stationarity may be an issue with the data for this study because the data series tend to increase over time. The validity of the approach to be used for this study depends on the ability to demonstrate that the data series are trend stationary. The procedures of Weersink et al. are followed to determine whether the data series are trend stationary or difference stationary. Dickey-Fuller tests were applied to the land values, net farm income, and government payments data series for Ontario. The results of these tests are provided in Table 1. For each of these series, difference stationarity is rejected in favour of trend stationarity at the 5% level of significance. This suggests that the approach taken in this study is appropriate.

The existence of unit roots in the data also is considered, as this issue can affect the validity of using the present value model. Each of the land values, net farm income, and government payments data series was subjected to tests, and the existence of unit roots in each series could not be rejected. However, if the residuals from a regression do not indicate the presence of a unit root, the use of the present value model may not be inappropriate. Because each data series was found to be trend stationary, a trend was incorporated into the framework. The resulting residuals were tested for unit roots, and
Table 1: Summary of Dickey Fuller Tests

<table>
<thead>
<tr>
<th>Series</th>
<th>DF Test Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmland Values</td>
<td>-3.663 *</td>
</tr>
<tr>
<td>Net Farm Income</td>
<td>-3.431 *</td>
</tr>
<tr>
<td>Government Payments</td>
<td>-3.878 *</td>
</tr>
</tbody>
</table>

* Significant at the 5% level of significance

The test results indicated that the presence of unit roots was rejected. Thus, the use of the PVM was assumed to be valid.

The simultaneous equation model utilized by Shaik, Helmers, and Atwood represents a framework that could potentially avoid the identification issue resulting from the inverse relationship between market returns and government payments. This study follows a similar approach, in an attempt to generate results that better represent the impacts of both types of returns on the value of farmland.

This approach begins with the traditional capitalization model, where land values are a function of net farm income, government payments, and interest rates. As the land values series was demonstrated to be trend stationary, a time trend is also included in the model. This model is represented by:

$$LV_t = \alpha_0 + \alpha_1 NFI_{t-1} + \alpha_2 GP_{t-1} + \alpha_3 T + \alpha_4 Rate + \varepsilon_t,$$

where $LV$ is farmland value, $NFI$ is net farm income, $GP$ is government payments, $T$ is the time trend, and $Rate$ is the real interest rate. The net farm income and government payments variables are lagged, as these revenues are often received later in the year due
to the nature of farming. Thus, the effects of these revenues on land values would not occur until the following year.

A positive relationship is expected between land values and both net farm income and government payments. However, there may be identification issues that arise due to the inverse relationship that often exists between these two explanatory variables. Government payments tend to be higher in years when net farm income has declined, as greater payments are triggered from support programs to compensate for decreased production or market returns. This issue can be addressed by specifying a second equation that accounts for this inverse relationship. This equation estimates government payments, with net farm income included as an explanatory variable:

$$GP_t = \beta_0 + \beta_1 NFI_t + \beta_2 GP_{t-1} + \nu_t \quad (7)$$

Lagged government payments is also included as an explanatory variable, as the level of government payments tends to be influenced by previous levels of payments due to continuity of specific programs.

Equations (6) and (7) are then simultaneously estimated using Seemingly Unrelated Regression (SUR). Results are reported in Table 2. Both net farm income and government payments are positively related to land values, as anticipated. The coefficient for the time trend is significant and positive. The relationship between the real interest rate and land values, expected to be negative, was positive but insignificant.
Table 2: SUR results for Ontario farmland values

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>t-stat</th>
<th>Elasticities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land values equation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-679.450</td>
<td>-2.612</td>
<td>*</td>
</tr>
<tr>
<td>Net farm income</td>
<td>6.530</td>
<td>4.412</td>
<td>* 0.468</td>
</tr>
<tr>
<td>Government payments</td>
<td>8.794</td>
<td>2.103</td>
<td>* 0.075</td>
</tr>
<tr>
<td>Trend</td>
<td>49.402</td>
<td>11.415</td>
<td>*</td>
</tr>
<tr>
<td>Interest rate</td>
<td>8.405</td>
<td>0.719</td>
<td></td>
</tr>
<tr>
<td><strong>Government payments equation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>12.773</td>
<td>2.554</td>
<td>*</td>
</tr>
<tr>
<td>Net farm income</td>
<td>-0.071</td>
<td>-2.092</td>
<td>* -0.589</td>
</tr>
<tr>
<td>Government payments</td>
<td>0.761</td>
<td>8.777</td>
<td>*</td>
</tr>
</tbody>
</table>

* Significant at the 5% level of significance.

The partial elasticities of land values with respect to net farm income and government payments were estimated from this model. These elasticities indicate that a 10% increase in net farm income would increase land values by 4.68%, while a 10% increase in government payments would increase land values by 0.75%. Thus, land values are found to be more responsive to changes in net farm income than to changes in government payments.

In the government payment equation, a negative relationship is indicated between payments and net farm income. This confirms the hypothesized inverse relationship between these two variables within a given year. An elasticity of -0.589 was estimated for government payments with respect to net farm income.

To test for changes over time in the effects of government payments on farmland values, a dummy variable is incorporated into equation (6), such that:
\[ LV_t = \alpha_0 + \alpha_1NFI_{t-1} + \alpha_2GP_{t-1} + \alpha_3T + \alpha_4Rate + \alpha_5D + \alpha_6DGP + \epsilon_t, \]  

where \( D \) is the dummy variable, such that \( D = 1 \) for 1991-2004, and \( DGP \) is the product of the dummy variable and government payments. This model tests for both slope and intercept changes for the relationship between land values and government payments.

The specification of the dummy variable follows from the observation in Shaik, Helmers, and Atwood that the effect of government payments on land values declined after 1990\(^1\). Thus, the existence of a similar trend in Canada is examined here.

SUR is then used to estimate equations (8) and (7). The results of this estimation are reported in Table 3. Both net farm income and government payments again display significant positive relationships with land values. The indicators of change in the impact of government payments on land values are represented by the coefficients on the dummy variables. The coefficient for the variable \( DGP \) is negative and significant, suggesting that the impact of government payments on land values was greater during the period prior to 1990 than during the period after 1990.

The elasticities can be used to measure the change that has occurred in the impact of government payments over time. The elasticity of land values with respect to net farm income is 0.353, indicating that a 10% increase in net farm income will result in a 3.53% increase in land values. The elasticity for government payments is 0.184 while the elasticity for the \( DGP \) variable is -0.068, indicating that land values became less responsive to government payments after 1990. Prior to 1990, a 10% increase in

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\(^1\) This decline actually appeared to begin after 1980, but the effects were reduced even further after 1990.
Table 3: SUR results – testing for a change in the effects of government payments

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>t-stat</th>
<th>Elasticities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land values equation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-372.354</td>
<td>-1.252</td>
<td></td>
</tr>
<tr>
<td>Net farm income</td>
<td>4.924</td>
<td>2.852 *</td>
<td>0.353</td>
</tr>
<tr>
<td>Government payments</td>
<td>21.505</td>
<td>2.719 *</td>
<td>0.184</td>
</tr>
<tr>
<td>Trend</td>
<td>41.082</td>
<td>5.892 *</td>
<td></td>
</tr>
<tr>
<td>Interest rate</td>
<td>-1.023</td>
<td>-0.078</td>
<td></td>
</tr>
<tr>
<td>Intercept Dummy (D)</td>
<td>412.890</td>
<td>1.495</td>
<td></td>
</tr>
<tr>
<td>Slope Dummy for GP (DGP)</td>
<td>-17.858</td>
<td>-1.913 **</td>
<td>-0.068</td>
</tr>
<tr>
<td><strong>Government payments equation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>12.788</td>
<td>2.558 *</td>
<td></td>
</tr>
<tr>
<td>Net farm income</td>
<td>-0.071</td>
<td>-2.096 *</td>
<td>-0.589</td>
</tr>
<tr>
<td>Government payments</td>
<td>0.761</td>
<td>8.777 *</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at the 5% level of significance.

** Significant at the 10% level of significance.

government payments caused a 1.84% increase in land values, but after 1990, a 10% increase in payments only resulted in a 1.16% increase in land values.

**IV. Policy Implications and Conclusions**

This study has examined the determinants of farmland values in Ontario and has estimated the extent to which the rate of capitalization of government payments into land values has declined in recent years. A Seemingly Unrelated Regression (SUR) framework was utilized to provide more accurate estimates of the explanatory variables, as the identification issue can be addressed through this framework.

In Ontario, the relative impact of government payments on land values was found to be less than that of net farm income, as land values were found to be more responsive to
changes in net farm income than to changes in government payments. This is contrary to
the findings of Weersink et al., however, this may be due to differences in the data sets.
The data set used for this study extended more than 10 years beyond the data set used in
the study by Weersink et al. Additionally, there are differences in the calculation of net
farm income.

The results of this study indicated that the impact of government payments on farmland
values in Ontario has declined since 1990. This time period coincides with the
introduction of farm support programs that are more decoupled from production than
their predecessors. These programs, such as NISA and CAIS, offer whole-farm income
protection instead of commodity-specific price protection, which reduces the influence
that these programs have on production decisions. This shift to more decoupled programs
may have contributed to the decline in the rate of capitalization of program payments into
farmland values.

If the estimated results of this study are accurate, there may be some policy implications.
The recent decline in the impact of government payments on land values may indicate
that the distorting effect of farm support programs on land values has been reduced. Thus,
these programs may be more effective in achieving their objectives of reducing income
loss for producers. If this is the case, even with the current high levels of government
support, the contribution of these programs to land values will be much lower than under
previous policy regimes.
References


