

Managing Extractive Resource Wealth for Sustainability: Lessons from Alaska Seen Through the Lens of Maximum Sustainable Yield

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by

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Alaska has enjoyed a generation of unprecedented economic growth and prosperity driven by crude oil production primarily from one giant field, Prudhoe Bay, on the North Slope. Through a number of financial savings accounts, including the Alaska Permanent Fund, the Statutory Budget Reserve, and the Constitutional Budget Reserve, the state has successfully converted a share of petroleum wealth into \$55 billion in financial assets. It has been less successful in diversifying the economic base away from dominance by oil and gas production. Now oil production has fallen to less than 1/3 of its peak and this decline is projected to continue—reducing public revenues and private economic activity.

This paper will explore whether the state of Alaska has the resources to be able to transition successfully to a Post-Prudhoe Bay economy, how that transition could take place, and what impediments might prevent a successful transition. This analysis will be of interest to other natural resource dependent economies that are trying to manage the cycles that resource extraction generate.

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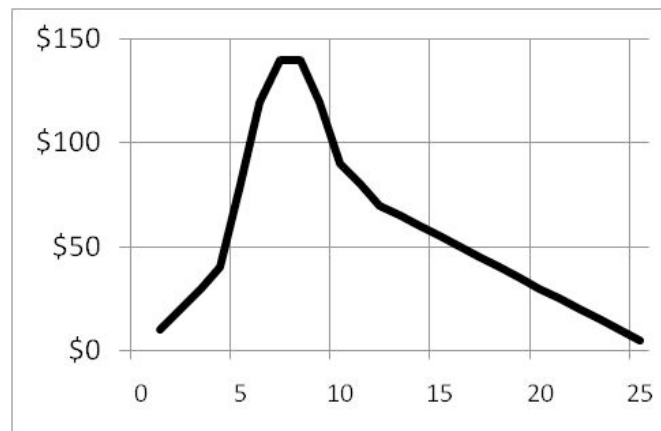


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MANAGING THE BENEFITS FROM A NON-SUSTAINABLE WINDFALL

Let's say I am the fortunate owner of land on which an oil well stands that will produce a financial windfall for me over a number of years from the production and sale of the oil. The time profile over which I would collect that windfall might look like Figure 1. After an initial period during which production ramps up there will be a few years during which I will collect a lot of money, and then, as depletion sets in, the revenues I will collect each year will taper off and eventually end when further production becomes prohibitively expensive.

Figure 1 Time Profile of Revenue from Production of an Oil Field



My good fortune creates a problem. How should I spread the consumption of this oil windfall over time, or to flip the question around--How much of the current revenue should I save each year? There are 4 obvious saving rules:

1. No Saving
2. Opportunistic Saving
3. Bird in the Hand

4. Permanent Income (including Maximum Sustainable Yield)

Under the **No Saving** rule I would consume the windfall as I collect the revenues, enjoying a party during the years of high production after which I would return to the consumption level I experienced before the windfall. This is a simple rule, but its attractiveness is inversely related to the size of the windfall relative to my regular income.

The **Opportunistic Saving** rule recognizes that I might want to spread the benefits from consuming the windfall beyond the time when the stream of revenues has dried up. It would then make sense to save some of the revenue as I collect it. It would also make sense to invest that saving in some asset that would yield a positive return. The simplest strategy would be to bank the savings. After the revenue stream from the windfall had dried up, I could extend its benefits by drawing on the savings account to keep my consumption above the pre-windfall level until the saving account was depleted. The saving rule then would be to put into the bank account any current revenues not consumed, recognizing that I will probably be glad I did when the well has stopped producing. But this rule does not provide any guidance about how much of current revenue should be saved.

The **Bird in the Hand** rule recognizes that the revenue I collect each year from the sale of my oil is not income, but rather the conversion of my physical asset into a different form, for example a financial asset if I banked it. If I put all the revenue each year into the bank and only drew on the earnings for consumption, the financial asset would grow at the same rate as the oil in the ground is depleted. When all the oil had been produced the value of the financial asset would be equal to the sum of all the revenues that I had collected from the production of the oil. Spending from the windfall would start small and grow over time with growth in the size of the financial asset.¹

¹ This is basically the approach taken by Norway and has some similarity to the approach suggested for Alaska by Roger Cremona which became known as the “Cremona Plan”

This rule is simple to understand and to implement, but it requires that I forego increased current consumption until the windfall accumulates in the financial account.

The **Permanent Income** saving rule also recognizes that the revenue from oil production is a conversion of my physical asset into a financial asset. However I now also recognize that the value of my oil windfall is not the sum of the revenues I will receive as the oil is produced, since some revenues will only be collected many years in the future, but rather the present value of those revenues. This is the amount I would receive if I could monetize or “bank” the entire windfall just as production begins, for example by selling off the property.

I again deposit all current revenue into a financial account that generates earnings. But now the amount I choose to spend on consumption each year is not constrained by the earnings of the financial asset, but rather is based on a determination of how I would like to allocate consumption of the windfall over time, unconstrained by the time profile of production.

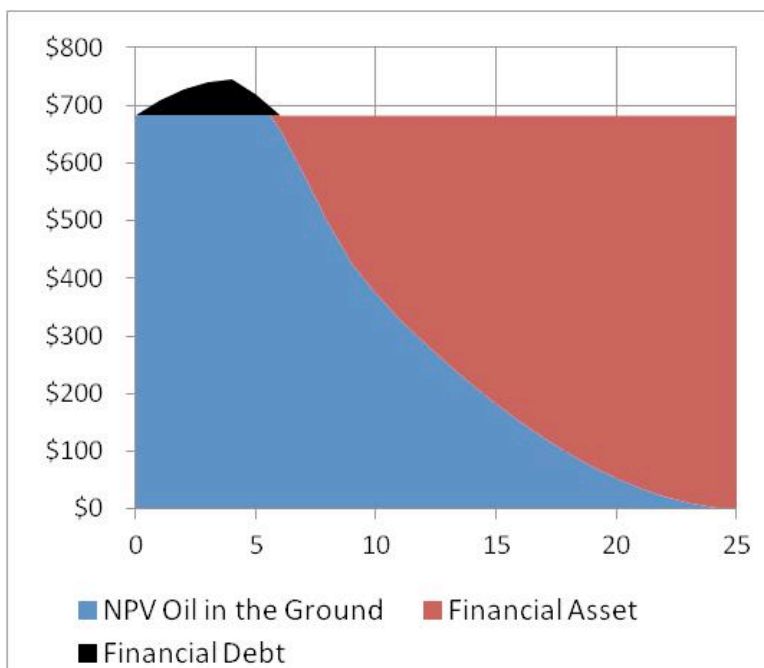
With this saving rule the link between current revenues collected and current consumption is severed. The time profile of consumption can be the one that maximizes benefits received over my lifetime, or beyond. This is simply an application of what economists call the permanent income hypothesis whereby individuals make their spending decisions at each point in time based on their expected lifetime or permanent income.

For example, if I am a young man when the oil begins to flow, I would have many years over which to spread the consumption of my windfall. If I am old, I would probably want to consume more each year. In either case I would want to allocate consumption from my windfall in a way that maximizes the benefits I receive unconstrained by when I actually collect the revenues from production.

A SPECIAL CASE: THE MAXIMUM SUSTAINABLE YIELD (MSY) RULE

A special case of the Permanent Income saving rule is the Maximum Sustainable Yield rule (MSY). In this case consumption is constant each year at a level that is the maximum that the windfall can generate without losing value. In this case the “bankable” value of the oil in the ground is gradually converted into a financial asset at just the rate that maintains the combined value of the oil in the ground and the financial asset at a constant level. The wealth portfolio, consisting of the present value of oil in the ground and the financial asset, stays constant (Figure 2)². And consumption from the wealth portfolio is also constant each year at the amount of earnings that the portfolio can produce each year.³

Figure 2 Composition of the Wealth Portfolio Using the MSY Savings Rule



² In the early years the annual revenues and earnings of the financial asset are less than the MSY consumption level, so I would initially borrow to be able to consume at the MSY consumption level. In subsequent years I would pay off that debt with annual revenues.

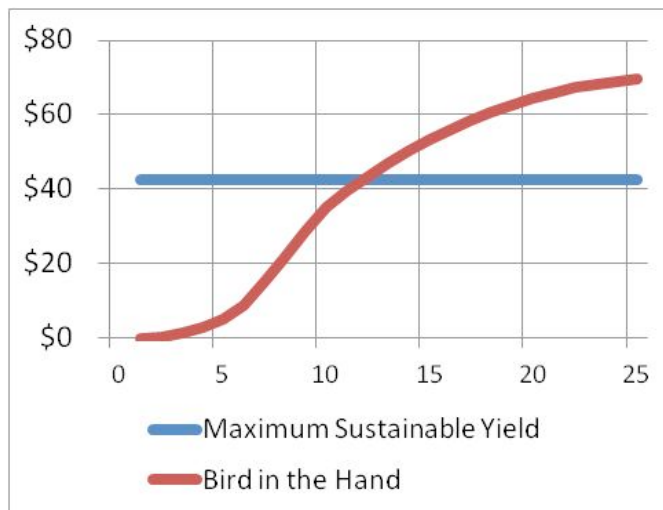
³ This is also known as the Harwick Rule.

I might adopt this rule if I have children and want to pass on to them the wealth I have received from the windfall⁴. If my children followed the same rule, they in turn could pass the wealth on to their children.

The motivation for this approach is similar to that of the Bird in the Hand rule. Both are designed to sustain the value of the initial windfall and both result in constant consumption over time after the revenues from oil production have all been collected.

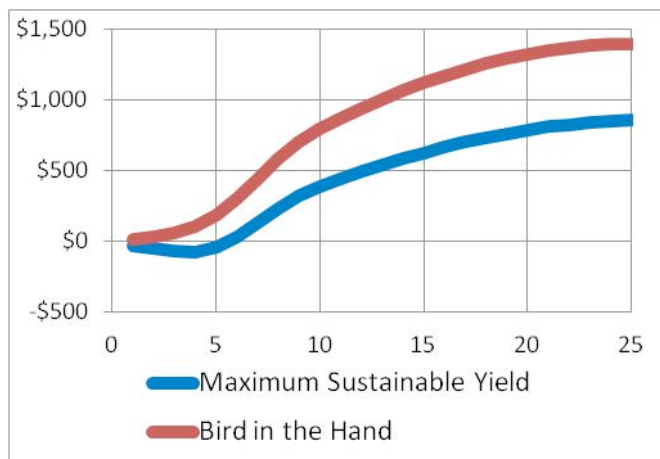
But there are two important differences between the two rules. First the time profile of spending is different. As Figure 3 shows, consumption is constant over time with the MSY rule while it starts low and grows over time with the Bird in the Hand rule. After the depletion of the resource annual consumption is constant in either case, but higher with the Bird in the Hand rule. Of course this is because it was initially lower allowing the balance in the financial account to grow ultimately larger. So the second difference is that the ultimate value of the financial asset is larger using the Bird in the Hand rule (Figure 4).

Figure 3 Time Profile of Consumption Using Two Different Saving Rules



⁴ This might also be called the “never spend principal” rule.

Figure 4 Time Profile of Financial Asset Balance Using Two Different Saving Rules



The Bird in the Hand rule skews the benefits from spending of the windfall towards the future. This alternative might be preferable if I felt I and my children would have less income in the future and had no other means today to smooth out consumption over time to compensate. However in the absence of the windfall, I should be able to plan my lifetime consumption in a way that gives me the maximum benefit. Adding the windfall to that calculation should not require favoring either the present or the future. On the basis of maximizing lifetime benefits I should prefer the MSY rule.

Application of the MSY rule is simple in theory. First determine the value of the oil in the ground if it could be “banked” immediately. Then determine the annual earnings the investment of that “banked” amount could produce. That becomes the Maximum Sustainable Yield consumption level.

In practice application of the rule is complicated by two things. First, in the absence of immediate “banking” of the windfall, its true value to me will only be revealed over time as the oil is produced. During that time both its price and the cost of its production are likely to change in unpredictable ways that will cause the value of oil still in the ground at any time to be different from that which I had anticipated. Furthermore technological advances could very well change the share of oil in the reservoir that is technically

recoverable. So estimates of the flow of revenue from the windfall will change as production proceeds, making it difficult to value the portfolio of oil and financial assets.

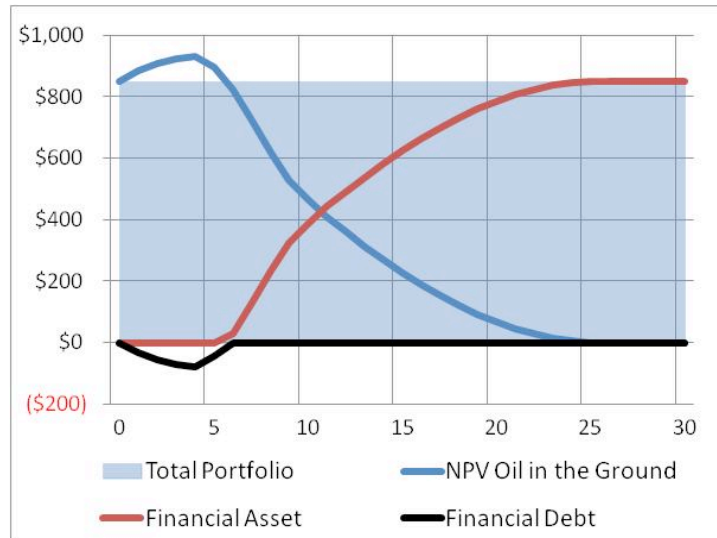
Differences of opinion regarding the value of oil in the ground (future revenues) can arise based on different interpretations of past experience, current conditions, and future expectations. Since different estimates of the size of the portfolio yield different MSY consumption amounts, it may be difficult to separate ones estimate of the size of the portfolio from ones desire to spend in the present.

The fact that the revenues from oil production are collected over the life of production from the field creates the second problem. That is the tendency to treat the revenue as income rather than the conversion of one asset in the portfolio into another. As a result there is a tendency to ask the question—How much should I be saving?—and think about a rule that involves either a constant amount or a constant percentage set aside from current revenue.

However the MSY rule entails a complicated wealth management strategy that has 4 distinct phases as shown in Figure 5.

1. Spend and Borrow
2. Spend and Save
3. Spend and Draw
4. Draw

Figure 5 4 Phases of MSY Management of Non-Sustainable Windfall



Each of these phases involves a different treatment of the revenue from current oil production, a different treatment of financial earnings, different savings “rates”, and involves a different composition of the wealth portfolio. (See the appendix for a numerical example.)

Current revenues from production are likely to initially be less than the MSY annual consumption level. Consequently all current revenues would be allocated to consumption and this would be augmented by borrowing to fund consumption at the MSY level. The wealth portfolio consists of a positive balance of oil but it is partially offset by a negative balance for financial assets.

In the second phase current revenues exceed the MSY annual consumption level. During this phase the revenues would be allocated between current consumption and new deposits into the financial account. Neither the amount deposited nor the share deposited into the financial account would be constant, but would rather vary over time to maintain the constant MSY consumption level. All the earnings of the financial asset would be reinvested.

Over time current revenues would decline to the point where they were less than the MSY annual consumption amount. After that time all current revenues would be

allocated to current consumption and the MSY consumption level would be maintained by drawing a portion of the earnings of the financial asset to supplement current revenues. The amount and share of earnings drawn from the financial asset would increase over time as current revenues fell.

The final phase of wealth management would occur when oil production ended and with it the revenues from the sale of the oil. From that point forward the MSY consumption level would be paid from the entire earnings of the financial asset. The annual draw would be both a fixed amount and a fixed percentage of the value of the wealth portfolio, now all held as a financial asset. One could think of the asset then as being managed as an endowment.

Of course there are other management structures that would also conform to the MSY consumption rule. For example all current revenues could be deposited in the financial account and the annual draw could be based on the MSY annual consumption amount. Although the draw would then be a constant amount each year, it would vary each year as a percentage of the balance in the financial account, starting at more than 100% and gradually falling as the balance in the financial account accumulated.

But whatever the MSY management structure, the saving rates—saving out of current revenues, saving out of financial earnings, and saving out of total cash flow (the sum of current revenues and financial earnings)—will vary over time. And this is difficult to understand and implement if the generally accepted wealth management question is-- How much to save?

The MSY rule can be readily modified to account for anticipated changes in future conditions. If I expect to have many children and want to give each a share equal to my own, I can reduce the current consumption from the wealth portfolio accordingly.⁵

⁵ For example, if the real return on the portfolio is 5% and the population growth rate is 1%, then an annual consumption draw of 4% would maintain the per capita value of the wealth portfolio by increasing its total value by 1% annually.

I don't need to restrict my wealth portfolio to oil in the ground and money in the bank in order to obtain the MSY consumption from the windfall. After all, all sorts of investments generate consumption benefits that can be just as valuable as those I get from spending cash. My well being depends not only on what I consume from spending the earnings on my bank account, but also on the benefits flowing from other types of investments.

For example, I might decide I want to put an addition on my house using a portion of the oil windfall. This and other capital investments can be incorporated into the MSY rule by including them as a separate account in the windfall portfolio. After all, the objective is benefit maximization rather than maximization of the flow of cash income. If the continuing benefit I get from the new addition on my house is as much as I get from spending the cash I receive from the annual draw on my financial account, I should make the investment.

Such infrastructure investments complicate the accounting somewhat. An infrastructure investment can be financed either by paying cash—taking it from the financial account—or by borrowing. Either way the value of the financial account falls by the value of the infrastructure that it finances, while at the same time the value of the “infrastructure account” increases by an equal amount.

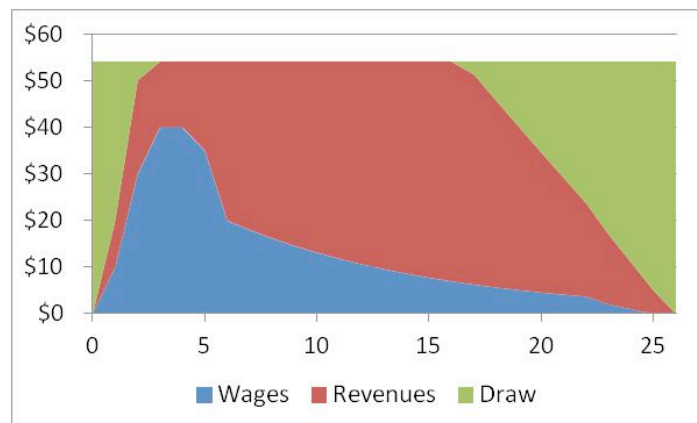
Now the MSY annual consumption is based on the wealth portfolio excluding the infrastructure account. It is less than before by the amount of the annual benefit from the infrastructure. The total annual benefit is unchanged but its composition is different.⁶

⁶ If the purpose of the investment is to generate a financial return rather than consumption benefits directly, then it only maintains the net worth of the portfolio if its financial return is equal to the financial return on the savings account.

This oil windfall also gives me the opportunity to obtain additional benefits beyond those associated with collecting the revenues and spending them on consumption. I could also get wage and profit income if I actively participated in the production of the oil. Then the MSY consumption would be greater because it would include the wages from my labor. The management of the MSY rule would now be complicated by the need to coordinate spending for current consumption not only from current revenues and the draw from the financial asset, but also from my wages.

For example if wages were spent when received then MSY would require more saving from current revenues to compensate for the consumption from wages. The sources of the MSY consumption level would look like Figure 6 over time.

Figure 6 MSY with Wages, Revenues, and Draw



OPERATIONALIZING THE MSY RULE: THE STATE OF ALASKA

Shortly after statehood Alaska had the good fortune to choose land from the federal government on the North Slope under which the largest oil field in North America, Prudhoe Bay, was soon discovered. Since 1977 production from that and surrounding fields has been more than 16 billion barrels of oil with a market value estimated at \$500 billion in 2010 dollars. State revenues from oil production have been about \$160 billion in royalties and various taxes.

The production profile of North Slope oil has roughly followed that of the hypothetical oil field discussed above. (Figure 7) State oil revenues have generally followed the same pattern except in the last few years when higher oil prices combined with changes in the production tax have significantly but only temporarily increased annual revenues. (Figure 8)

Figure 7 North Slope Oil Production (Million barrels per day)

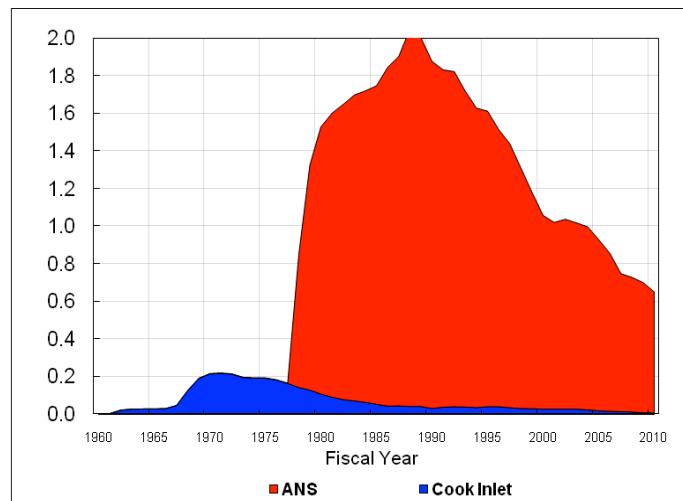
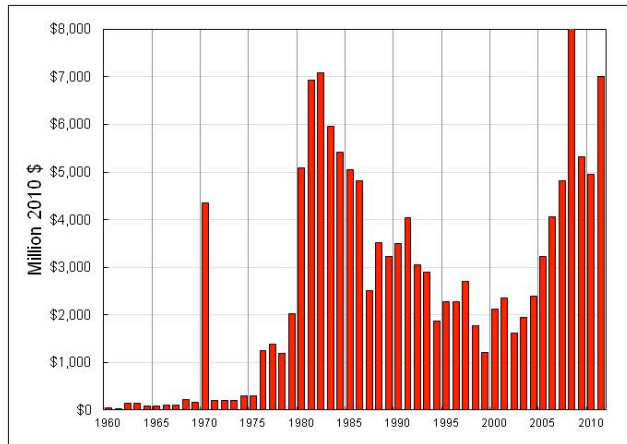
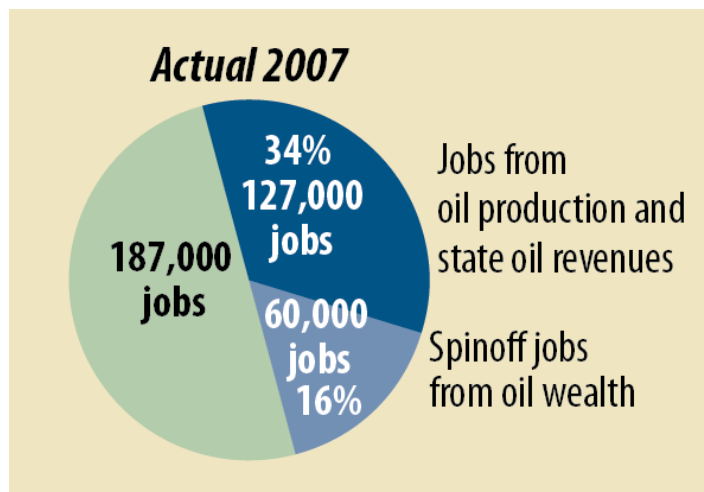


Figure 8 Alaska Oil Revenues (Million 2010 \$)



Activities associated with the exploration, development, production, and transportation of this oil as well as the spending of the revenues collected by the state, have dominated the economy and economic growth for more than a generation. A recent analysis suggests that 2/3 of the growth in jobs and income since Alaska became a state, and 1/2 of all jobs and income today, can be attributed to these activities and the spinoffs they have generated such as low tax burdens on households and businesses.⁷ So the economy would only be about 1/2 its current size without the developments attributable to oil.

Figure 9 What Accounts for Alaska Jobs



⁷ Scott Goldsmith, "Oil Pumps Alaska's Economy to Twice the Size - But What's Ahead?" UA Research Summary 17, Institute of Social and Economic Research, February 2011.

Even before production began, the state recognized the need to save a portion of the windfall as it was collected as revenues for three reasons—to keep the money out of the hands of the politicians, to keep the economy from overheating, and to save for the post petroleum future.

Management of the windfall has involved consuming about 77% when received. This has been a combination of public operating and capital expenditures, capitalizing a number of state agencies with targeted functions, and making loans for various purposes. The remaining 23% has gone into 3 financial savings accounts—the Alaska Permanent Fund, the Constitutional Budget Reserve, and the Statutory Budget Reserve—each of which was created at a time of excess current revenues and with a different purpose. In addition some cash is held in the state General Fund.

The objective of the Permanent Fund is to save a share of oil revenues in recognition of the fact the oil resource is not sustainable. It has been funded through constitutionally required deposits of a share of oil royalties and augmented by discretionary contributions when oil revenues have been high and the reinvestment of a portion of earnings. The Permanent Fund dividend, an annual payment to each Alaskan, is paid from a share of the earnings of the Fund. The Permanent Fund has a balance of about \$40 billion.

The objective of the Constitutional Budget Reserve is to provide a buffer against the year to year fluctuations in oil revenues. It has been funded with deposits received from the petroleum industry from the settlement of outstanding tax and royalty disputes. Earnings are retained in the fund. Withdrawals can be made when current year revenues fall short of prior year spending, but in years of high revenues, any money previously borrowed from the fund must be repaid. The Constitutional Budget Reserve has a balance of about \$12 billion.

The objective of the Statutory Budget Reserve is similar to that of the Constitutional Budget Reserve except its use is less restrictive. Like surplus revenues held in the General Fund, it is available for appropriation without constraints. These two funds together contain about \$3 billion.

Policies have also been put in place to control spending and thus make more current oil revenues available for deposit into the financial accounts. The first such policy was to prohibit the withdrawal of deposits made into the Permanent Fund by a constitutional amendment. The second was to institute a spending cap with annual upward adjustments for population growth and inflation. But it has never been a constraint on spending since it was initially set too high at a time of unusually high spending. The third has been through restriction of access to the money held in the Constitutional Budget Reserve unless current revenues are less than spending in the prior year.

There is also an informal check on spending the earnings of the Permanent Fund not allocated to payment of the dividend since most Alaskans would prefer to see that money reinvested to increase the size their future dividends.

There have been episodes in the past when revenues were low and the state was forced to borrow from the Constitutional Budget Reserve to meet current spending needs. During those times there has been some belt tightening as well as discussions about broadening the tax base to reduce dependence on oil revenues which account for about 90% of state revenues. However these discussions have not led to action and the state is as dependent on oil revenues today as it was 30 years ago.

And when oil revenues are high, there are no real constraints on spending except for the vague sense that a share of any surplus should be put into savings against the time when the revenue stream from oil falls off and dries up.

Today there is a growing sense of urgency regarding the management of the oil windfall, not because current revenues are low but rather because concerns have been

raised about the ability of the Trans Alaska Pipeline, which carries Alaska oil to market, to operate at the low flow rates projected in future years due to declining North Slope production. If the oil pipeline were to shut down and the flow of North Slope oil were to stop, the consequences for the economy would be devastating--both in terms of taxes and employment.

The state is in a strong fiscal position at the moment with financial assets of about \$55 billion and a current revenue surplus of about \$2 billion based on a budget of \$6 billion. However the official 10 year fiscal forecast projects a current account deficit in only a few years as spending continues to grow and oil revenues fall due to further declines in production. The available financial asset to cover this shortfall—the \$15 billion mostly in the Constitutional Budget Reserve—would only last a few years before the state would potentially face a fiscal crisis.⁸

The crisis would require the state to institute some combination of spending cuts (including reduction or elimination of the Permanent Fund dividend), new taxes (income and sales), and perhaps breaching the constitutional protection prohibiting use of the Permanent Fund to balance the budget.

With excess current revenues but concerns about our fiscal future, the question is how much of these revenues can the state spend on current consumption and how much should be set aside in savings accounts. The Maximum Sustainable Yield rule provides one answer to that question.

⁸ The Alaska constitution allows spending of only the earnings of the \$40 billion Permanent Fund.

UNCERTAINTY, INFRASTRUCTURE, JOBS, DISTRIBUTION OF THE BENEFITS

Applying the Maximum Sustainable Yield savings rule to an entire economy involves a number of issues that are not important for the individual. It is useful to mention several before discussing possible implementation for Alaska.

Uncertainty

The ultimate value of the windfall is revealed only over a period of years and is influenced by price, production, technology, and geology, as well as tax and royalty policies of government. In recent years for example high oil prices and changes in the state production tax have increased the “bankable” value of oil in the ground. This in turn makes it difficult to establish and agree upon a MSY level of consumption.

This can be dealt with by periodically revaluing the portfolio and making MSY consumption adjustments as warranted. Furthermore the MSY consumption level can be risk adjusted to reflect the uncertainty in the ultimate value of the portfolio. A downward adjustment would be consistent with the preference to avoid the ultimate pain from overestimation and vice versa.

These periodic revaluations may initially be large but as the oil in the ground is transformed into financial assets that tend to maintain a more stable value over time, the fluctuations in the value of the portfolio will fall and with it the fluctuations in the MSY consumption level.

The periodic revaluations of the portfolio and the MSY consumption level underscore the notion that this approach to wealth management should be considered as a general guide rather than a strict rule.

Infrastructure Investments

Consumption benefits from the windfall will be maximized by some combination of spending on operating and capital expenditures. An infrastructure investment is a way to transform oil in the ground into a sustainable source of wealth just like a financial asset. The mix of financial assets and infrastructure investments in the oil wealth portfolio should equilibrate the benefits that flow from the two different types of assets.

For example one type of infrastructure investment would be a project that reduces the cost of energy for households and businesses. It could be part of the wealth portfolio if the continuing benefits from that investment—the future stream of savings to energy consumers—were equal to those obtainable from the income from an equally sized financial investment.

The savings from the energy project would become part of the MSY consumption level. In this case the annual consumption from current oil revenues and the earnings of the financial asset would be reduced by the amount of the energy cost savings.

In practice it is extremely difficult to measure and to reach agreement on the benefits of public spending, either on current consumption or on infrastructure investments. However the annual rate of return on the financial assets does provide a benchmark against which to measure the value of any infrastructure investment. Wealth held as financial assets generates a flow of annual earnings that can be allocated to either consumption or investment in future years. Only if the infrastructure investment can generate a flow of benefits that can match that flow in value should it be undertaken. In the absence of being able to measure the benefits directly, the flow of dollars can serve as a proxy for that comparison.

Jobs and Local Business Activity

The Alaska economy is about twice the size it would have been today without oil. This is only partly due to the activities associated with oil development and production and more the result of the expenditure by state government of the revenues collected from

oil production. The jobs and wages (and business profits) generated by these activities represent a benefit to Alaskans in addition to the value of the public goods and services purchased by the windfall.

Should management of the wealth portfolio include consideration of the benefits from employment and other business activity? If consumption of the windfall is constant over time according to the MSY rule, then the jobs associated producing that flow of consumption would also be constant over time, and sustainable.

On the other hand, the jobs associated with production of the oil may follow a time pattern similar to the production profile and generate a boom-bust situation. Minimization of the adverse consequences of a production generated boom-bust could be accomplished by reducing windfall consumption during the high production years and gradually increasing windfall consumption as production, and the jobs associated with that production, decline.

However there has been no significant boom-bust in Alaska associated with the rise and fall of oil production. Declining well productivity and increasing maintenance requirements have resulted in growing employment as production has declined.

Furthermore the likelihood is high that production related employment will remain at the current level, or even increase, as exploitation of the oil resources in Alaska proceeds. Although the conventional oil reserves on state lands, the basis for the state windfall, have now mostly been produced, there are numerous other oil resource categories that could be produced in the future. These include oil on federal lands--both onshore and offshore--as well as unconventional oil deposits such as viscous and heavy oil and oil in shale formations. They also include conventional natural gas and methane hydrates.

Exploitation of any of these resources is not likely to produce windfall revenues for the state on the same scale as Prudhoe Bay and the other conventional oil pools on state land for two reasons. First, the federal government collects the royalties on production

from federal lands and that production is also exempt from some or all state taxes. Second, all these resources will be costly to produce and move to market and may have a lower value than conventional oil when they arrive. This means that the tax base from production of these resources would be much lower on a per barrel basis than oil from Prudhoe Bay.

As long as oil production related jobs continue at the current or expanded level, there is no need to adopt a countercyclical policy for the oil windfall to prevent an economic decline after production associated with the windfall.

On the other hand, a pro-cyclical MSY policy might be appropriate to provide an increasing number of jobs over time to accommodate a growing supply of labor. This could be accomplished by adjusting the MSY consumption level downward to allow for reinvestment of a share of current earnings to increase the size of the portfolio and consequently future earnings. For example if annual windfall earnings was 5% and population growth was expected to be 1% per year, the MSY consumption level could be reduced from 5% to 4%. The 1% of earnings reinvested would increase the portfolio by 1% each year, thus allowing the additional population to share in the windfall at the same level as the current population. Total consumption would grow at 1% each year and with it the jobs necessary to deliver the additional consumption. This would then accommodate a portion of the increase in the supply of labor associated with the population increase.

Benefit Distribution

The benefits of public consumption flow to all residents but the wages and profits associated with providing those goods and services as well producing the oil go to only a few. Since there is no way to distribute the wages and profits evenly to all residents, the benefits of the windfall cannot be equitably distributed among community residents either at any point in time or over time.

Furthermore, this raises the question of identifying the beneficiary group. The production of the oil and the spending of the windfall will inevitably generate jobs which will increase the demand for labor and draw population into the region. Although in other places there might be restrictions on migration or citizenship, in the United States there is no way to prevent new migrants into a state from sharing in the benefits of public spending. And for that matter, the newborn children of current residents are also new residents.

The only way to ensure that a windfall exclusively reaches a particular target population is to distribute it directly to that population as a one-time payment. Individuals could then decide how to distribute consumption from that windfall between today and the future. But because it is based on oil production, the Alaska windfall cannot be distributed as a one-time payment. If it were distributed when received migrants would move to the state in anticipation of the installment payment of the windfall. And if the windfall could be immediately “banked” and then distributed in one payment, it would only benefit those residents present in the state at that time and could also create a dramatic economic boom followed by an equally dramatic bust.

The Alaska Permanent Fund dividend was instituted partly in recognition of the inequity in the distribution of benefits from oil production and the spending of the windfall. All current residents receive an equal payment from fund earnings (and ultimately from oil wealth since that is the source of Fund contributions). Since it is consumption from the windfall, it is part of the MSY consumption level. Because the dividend is paid out of the earnings of the Permanent Fund, its size is based on application of the Bird-in-the-Hand saving rule so it favors later rather than earlier generations of Alaskans.

MAXIMUM SUSTAINABLE YIELD (MSY) IMPLEMENTATION

Alaska fiscal year 2013 (July 2012 to June 2013) petroleum revenues are projected to be \$8 billion. State financial assets will also generate about \$2.5 billion in earnings (net of inflation). Since these financial assets have been funded by past oil revenues, their earnings should be attributable to oil wealth. Thus the total cash flow from petroleum in 2013—oil revenues plus earnings of financial assets--will be about \$10.5 billion.

Since state general fund spending is projected to be only about \$6.5 billion, of which 90% would be paid for with oil revenues, and about \$1 billion of Permanent Fund earnings will be allocated to payment of the dividend, it seems that state finances are in a strong position. The cash flow from oil related sources is \$10.5 billion while consumption from those sources is \$7 billion. However this fails to recognize that the oil revenues are not sustainable. Applying the MSY savings rule adjusts for this.

State financial assets contain \$55 billion. More difficult to estimate is the “bankable” value of oil still in the ground (the net present value of future revenues) since the state does not forecast revenues further than 10 years in the future. However after 10 years most conventional oil on state lands will have been produced and additional oil production will primarily come from federal lands and unconventional resources. Both are likely to produce a lower return per barrel to the state than conventional oil because the federal government will take most of the taxes and/or because this oil will be more costly to produce. Furthermore because of discounting, oil revenues more than 10 years in the future will have a low present value.

Consequently most of the “bankable” value of oil in the ground lies with conventional oil on state lands. Discounting the latest projection of future revenues to estimate the “bankable” value of conventional oil production (including an extrapolation beyond 10 years until the conventional oil has all been produced) yields a net present value of \$76 billion (5 billion barrels of production). Adding a \$9 billion estimate for the net present

value of revenues from production from federal lands, unconventional sources, and natural gas results in a grand total value of \$85 billion.

Combining the “bankable” value of oil in the ground with the value of state financial assets results in a grand total oil wealth portfolio of \$140 billion. The MSY consumption level from that portfolio would be \$7 billion at a 5% real rate of return. If the Alaska population were growing at 1% per year and we wanted to provide the new population with the same consumption level in the future as enjoyed by the current generation, that growth rate would need to be subtracted from the real rate of return. Then the MSY consumption level would fall to \$5.6 billion.

Since actual consumption in 2013 at the currently forecast level would be about \$7 billion, the state is consuming at or above the MSY level. Without incorporating population growth into the calculation consumption at the current level is sustainable but future consumption growth would not be sustainable (except to account for inflation). If population growth is included, consumption is \$1.4 billion higher than the sustainable level. Any future increases in public spending would need to come from a sustainable source such as an income or sales tax to prevent erosion of the oil wealth portfolio.

With an MSY consumption target of \$5.6 billion (accounting for population growth) and actual consumption of \$7 billion, the state would be eroding the value of its oil wealth by \$1.4 billion in 2013. This reduces the MSY consumption level in future years, and future generations of Alaskans will bear a FISCAL BURDEN of that amount. In other words they would have to repay the oil wealth portfolio by that amount through new taxes to bring it back to its current value, or they would have to be satisfied with a lower annual consumption level from the MSY. And every year that actual consumption exceeds the MSY level, the FISCAL BURDEN would increase.

An obvious reason why MSY has not been adopted is that many businesses, established property owners, and get-rich quick migrants continuously lobby to increase current spending from the windfall for personal reasons. But even for those looking

beyond their own self interest, there are a number of arguments against saving more or against public saving in general.

- Governments should not have financial savings accounts. All revenues not necessary to fund current public service needs should be distributed to individuals. They know best how to manage a windfall.
- A financial saving account takes money away from the economy where it could be working to create jobs and other economic benefits and instead helps someone else. This is a particular concern because Alaska has had a shortage of capital in the past that has prevented development of its vast storehouse of natural resources. Instate investments would then create not only a financial return, but also jobs for residents. But supporters of this position rarely produce much analysis to support the conclusion that the value of the instate investments (benefits to consumers, economic development, etc) combined with the benefits of job creation (wages) exceed those of an equal sized financial investment. Furthermore instate investments can have boom-bust economic consequences and concentrate the wealth portfolio in Alaska when a prudent investor would diversify its holdings outside the state.
- The wealth belongs to the current generation. Future generations should take care of themselves. Or we cannot know what future generations will want and consequently we should not deprive ourselves of the benefits of the windfall. Or future generations will be richer because of technological advances so why should we deprive ourselves of the benefits of the windfall. Or future generations may not act responsibly by saving themselves, so why should we just save so they can have a party.
- Life in Alaska was better before the oil windfall because the population was smaller, people were less concerned about money, and there was a greater sense of community. The sooner the flow of benefits from the windfall ends, the sooner things will return to the “good old days”.
- The population is dominated by optimists who, having already been successful in Alaska, feel that the future will continue to be positive (the winner’s curse). The

history of Alaska is one of booms and busts but the state economy has come out of each one stronger. The pessimists have always been wrong in the past, so there is no reason to save for a rainy day that will never come.

- Living off financial earnings results in the creation of a “rentier” society of “trust fund babies” or trustafarians (the unmotivated slacking children of privilege). This has negative consequences such as a decline in participation in public discourse. But in reality Alaskan already is a “rentier” society. However the trust fund is the tax base—oil in the ground and its transformed sustainable form—financial assets.
- Public financial accounts results in the overexpansion of the public sector and creation of a bloated bureaucracy due to the availability of public funds not tempered by the annual requirement that they be collected as taxes. However windfall earnings need not be the only source of public consumption. Both taxes and the option of distribution of a share of earnings (like the Permanent Fund dividend) instill some modicum of fiscal discipline.

But even if Alaskans could generally reach agreement on the need to save more, there are numerous practical impediments to doing so.

- Political pressure to spend. Implementation of MSY would divert current revenue into saving, forcing either budget cuts or the imposition of new taxes. The legislature and governor are unlikely to approve either measure when current revenues exceed expenses. The political pressure to spend to meet ever increasing current needs is virtually impossible to counter.
- Limited understanding of how much we are currently saving. Without counting spending of Permanent Fund earnings to fund the dividend, annual savings is overestimated.
- Limited understanding of how much we should be saving. The MSY calculation is not easy for policy makers and the general public to understand.
-
- Uncertainty about the size of the oil windfall.

- Uncertainty about the long run real rate of return on investments.
- Uncertainty about the future growth of the economy through economic diversification and with it the population.
- Differing opinions about risk aversion.

In addition the state does not have appropriate institutional arrangements in place for saving and spending consistent with MSY. The spending limit is inadequate both because it was initially set too high and because it is not a limit on spending from oil wealth but rather a limit on total spending. Consequently there is no guideline for how much oil wealth consumption is to appropriate.

The state has 4 major financial accounts, none of which is designed to function as an MSY financial asset as described in this paper. The Permanent Fund comes closest because only its earnings can be spent. Savings in the other accounts—The Constitutional Budget reserve, the Statutory Budget Reserve, and the state General Fund are not protected by the Constitution as is the Permanent Fund so their balances are not protected from spending on current consumption. They have been used in the past, and it is generally accepted that they will be used in the future as well, to fund any budget shortfalls.

However, in spite of these barriers to full implementation, there are a number of measures the state could institute that would move toward an oil wealth management system that incorporates MSY.

- 1) Establish a new endowment fund and bankroll it with the current balances of the Constitutional Budget Reserve, the Statutory Budget Reserve, and the General Fund. Leave only enough in the Constitutional Budget Reserve to cover anticipated fluctuations in annual revenues around the longer term downward trend. Alternatively put all excess financial resources into the Permanent Fund, preferably in a subaccount that does not feed into the Permanent Fund Dividend formula.
- 2) Establish an advisory cap for oil wealth consumption that includes both General Fund and financial account (currently the Permanent Fund dividend) spending.

- 3) Establish explicit criteria to enforce discipline on both capital and operating spending. When current revenues are high there is inescapable pressure to expand the capital budget with hard-to-justify projects. When current revenues are low it is difficult to cut the operating budget. The absence of broad based taxes against which to judge the value of spending makes it uniquely difficult in Alaska to control budget growth. Explicit criteria would help legislators and the governor to impose more discipline on the system.
- 4) Increase state capacity and expertise to analyze economic effects of petroleum fiscal regime changes. Since oil wealth is Alaska's most valuable asset, its proper management requires an understanding of how future revenues and employment will be impacted by changes in tax and royalty structures.
- 5) Report each year on the fiscal health of the state. Currently the Office of Management and Budget produces a 10 year budget projection. That exercise needs to extend beyond that time to incorporate a more complete picture of the expected future decline in oil revenues and the uncertain prospects for revenues from exploitation of new reserves to not only compensate for that decline but also to allow for continued growth in state spending. The annual presentation of this projection should be the focal point for a discussion of progress in the effort to create long term fiscal stability and economic growth.
- 6) Implement the "percent of market value" (POMV) approach to managing the Alaska Permanent Fund without changing the way the Permanent Fund Dividend is calculated.⁹ This would both stabilize annual revenues available for appropriation from the fund and increase the capability of the fund managers to maximize the long run rate of return of the fund.
- 7) Establish tax and spending triggers. These mechanisms that automatically introduce and/or increase or decrease taxes and /or spending under predetermined conditions (for example, a drop in the Constitutional Budget Reserve balance below a target level) could be put in place in a non crisis environment.
- 8) Set a target to have \$100 billion in financial savings accounts by the year 2020.

⁹ This is essentially the proposal to treat the Permanent Fund like an endowment for the purposes of managing its investment portfolio and establishing an annual withdrawal target.

CONCLUSION

The Maximum Sustainable Yield savings plan is only one possible strategy for managing an oil windfall. It has a number of advantages but is also difficult to establish and maintain. Although Alaska has not implemented this strategy it does recognize that the revenues it is receiving from the production of Prudhoe Bay oil are a windfall that should be managed to maximize the long term benefits of Alaskans and that saving a share of current revenues is how this should be done. The Alaska experience provides some lessons for other places faces with the same good fortune.

The most important lesson is to begin as early as possible to think about the windfall as a one-time increase in wealth for the community and to try to determine the size of the windfall. Then it would become possible to craft a plan that allocates the spending of that wealth between the current and future generations. From that determination a savings plan would emerge that would meet the goals of the spending plan.

The savings plan itself would be complicated because neither the amount nor the rate of saving of current revenues from oil production would be constant. Thus it is easier to portray the management strategy as a spending rather than as a savings plan.

Annual consumption comes from any combination of current oil revenues and financial asset earnings (cash flow), but a preferable long term strategy would be never to draw more from the financial asset than the annual investment return. It should be treated like an endowment from its creation. That makes it easier to maintain spending discipline when most of the oil wealth has been transformed from oil in the ground into the financial asset.

Consumption above the MSY level must come from sources other than the resource so other sources of revenue should not be done away with unless it can be shown that they will never be required. For example it is better to temporarily suspend taxes than

to eliminate them altogether. Retaining taxes also provides a clear test of the value of public consumption.

Finally, every place enjoying a windfall will have unique circumstances that influence how it should be managed. For example a number of small Alaska communities have in the past or are currently experiencing oil and mining related non sustainable windfalls. Most have small populations with economies that had been dependent largely on subsistence activities and with limited possibilities for sustained economic development linked to the market economy after these oil or mineral resources have been produced.

These communities have put more emphasis on “people prosperity” in their benefit distribution decisions than has the state by concentrating more resources on job creation for residents. However finding the right mix between “people prosperity” and “place prosperity” will continue to be a challenge for these small communities (as it is for the state of Alaska) because “people prosperity” could enhance the opportunities for outmigration.

APPENDIX

Maximum Sustainable Yield														
WEALTH PORTFOLIO							CONSUMPTION			CASH FLOW	RATES			
REVENUES			FINANCIAL ASSET			SUM								
Current Revenue	NPV Future Revenue	Saved Revenue	Financial Asset Balance	Financial Asset Earnings	Financial Asset Reinvest	Wealth Portfolio: Sum of Assets	Annual Consumption	Current Revenue Spend	Financial Asset Draw		Saving Rate (D/A)	Draw Rate	Cash Flow	
(A)	(B)	(C)	(D)	(E)	(F)	(B+F=G)	(H)	(I)	(J)	(K=A+E)	(L=C/A)	(M=J/D)	(N=H/K)	
	\$852.1					\$852.1								
\$ 10	\$884.8	(\$32.6)	(\$32.6)	\$0.0	\$0.0	\$852.1	\$42.6	\$10.0	\$32.6	\$10.0	0.0%	-100.0%	426%	
\$ 20	\$909.0	(\$22.6)	(\$56.8)	(\$1.6)	(\$34.2)	\$852.1	\$42.6	\$20.0	\$22.6	\$18.4	0.0%	-39.8%	232%	
\$ 30	\$924.4	(\$12.6)	(\$72.3)	(\$2.8)	(\$25.4)	\$852.1	\$42.6	\$30.0	\$12.6	\$27.2	0.0%	-17.4%	157%	
\$ 40	\$930.7	(\$2.6)	(\$78.5)	(\$3.6)	(\$16.2)	\$852.1	\$42.6	\$40.0	\$2.6	\$36.4	0.0%	-3.3%	117%	
\$ 80	\$897.2	\$37.4	(\$45.0)	(\$3.9)	(\$6.5)	\$852.1	\$42.6	\$42.6	\$0.0	\$76.1	46.7%	0.0%	56%	
\$ 120	\$822.1	\$77.4	\$30.1	(\$2.3)	(\$2.3)	\$852.1	\$42.6	\$42.6	\$0.0	\$117.7	64.5%	0.0%	36%	
\$ 140	\$723.2	\$97.4	\$129.0	\$1.5	\$1.5	\$852.1	\$42.6	\$42.6	\$0.0	\$141.5	69.6%	0.0%	30%	
\$ 140	\$619.3	\$97.4	\$232.8	\$6.4	\$6.4	\$852.1	\$42.6	\$42.6	\$0.0	\$146.4	69.6%	0.0%	29%	
\$ 120	\$530.3	\$77.4	\$321.9	\$11.6	\$11.6	\$852.1	\$42.6	\$42.6	\$0.0	\$131.6	64.5%	0.0%	32%	
\$ 90	\$466.8	\$47.4	\$385.3	\$16.1	\$16.1	\$852.1	\$42.6	\$42.6	\$0.0	\$106.1	52.7%	0.0%	40%	
\$ 80	\$410.1	\$37.4	\$442.0	\$19.3	\$19.3	\$852.1	\$42.6	\$42.6	\$0.0	\$99.3	46.7%	0.0%	43%	
\$ 70	\$360.6	\$27.4	\$491.5	\$22.1	\$22.1	\$852.1	\$42.6	\$42.6	\$0.0	\$92.1	39.1%	0.0%	46%	
\$ 65	\$313.7	\$22.4	\$538.5	\$24.6	\$24.6	\$852.1	\$42.6	\$42.6	\$0.0	\$89.6	34.5%	0.0%	48%	
\$ 60	\$269.4	\$17.4	\$582.8	\$26.9	\$26.9	\$852.1	\$42.6	\$42.6	\$0.0	\$86.9	29.0%	0.0%	49%	
\$ 55	\$227.8	\$12.4	\$624.3	\$29.1	\$29.1	\$852.1	\$42.6	\$42.6	\$0.0	\$84.1	22.5%	0.0%	51%	
\$ 50	\$189.2	\$7.4	\$662.9	\$31.2	\$31.2	\$852.1	\$42.6	\$42.6	\$0.0	\$81.2	14.8%	0.0%	52%	
\$ 45	\$153.7	\$2.4	\$698.5	\$33.1	\$33.1	\$852.1	\$42.6	\$42.6	\$0.0	\$78.1	5.3%	0.0%	55%	
\$ 40	\$121.4	(\$2.6)	\$730.8	\$34.9	\$34.9	\$852.1	\$42.6	\$40.0	\$2.6	\$74.9	0.0%	0.4%	57%	
\$ 35	\$92.4	(\$7.6)	\$759.7	\$36.5	\$33.9	\$852.1	\$42.6	\$35.0	\$7.6	\$71.5	0.0%	1.0%	60%	
\$ 30	\$67.1	(\$12.6)	\$785.1	\$38.0	\$30.4	\$852.1	\$42.6	\$30.0	\$12.6	\$68.0	0.0%	1.6%	63%	
\$ 25	\$45.4	(\$17.6)	\$806.7	\$39.3	\$26.6	\$852.1	\$42.6	\$25.0	\$17.6	\$64.3	0.0%	2.2%	66%	
\$ 20	\$27.7	(\$22.6)	\$824.5	\$40.3	\$22.7	\$852.1	\$42.6	\$20.0	\$22.6	\$60.3	0.0%	2.7%	71%	
\$ 15	\$14.1	(\$27.6)	\$838.1	\$41.2	\$18.6	\$852.1	\$42.6	\$15.0	\$27.6	\$56.2	0.0%	3.3%	76%	
\$ 10	\$4.8	(\$32.6)	\$847.4	\$41.9	\$14.3	\$852.1	\$42.6	\$10.0	\$32.6	\$51.9	0.0%	3.8%	82%	
\$ 5	\$0.0	(\$37.6)	\$852.1	\$42.4	\$9.8	\$852.1	\$42.6	\$5.0	\$37.6	\$47.4	0.0%	4.4%	90%	
\$ -	\$0.0	(\$42.6)	\$852.1	\$42.6	\$5.0	\$852.1	\$42.6	\$0.0	\$42.6	\$42.6	#DIV/0!	5.0%	100%	
\$ -	\$0.0	(\$42.6)	\$852.1	\$42.6	\$0.0	\$852.1	\$42.6	\$0.0	\$42.6	\$42.6	#DIV/0!	5.0%	100%	
\$ -	\$0.0	(\$42.6)	\$852.1	\$42.6	\$0.0	\$852.1	\$42.6	\$0.0	\$42.6	\$42.6	#DIV/0!	5.0%	100%	
\$ -	\$0.0	(\$42.6)	\$852.1	\$42.6	\$0.0	\$852.1	\$42.6	\$0.0	\$42.6	\$42.6	#DIV/0!	5.0%	100%	