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Abstract

In this paper, we introduce a production function that is consistent with the Laws of Thermodynamics, and which acknowledges that production without energy is impossible. We start by exploring how the fundamental role of energy in production came to be lost from economics for almost a quarter of a millennium.

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Data for: The role of energy in production

Data for GDP, energy, capital (per head) and the employment rate for the USA from 1960

The role of energy in production

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Introduction

"Land is the source or matter from which all wealth is drawn; man's labor provides the form for its production, and wealth in itself is nothing but the food, conveniences, and pleasures of life." (Cantillon 1755, p. 21)

So began the first major work of the only School of Thought in economics to accord energy, as then understood, its pivotal role in production: the Physiocrats. Though their halcyon days pre-dated the development of the Laws of Thermodynamics by a century, their model of production was compatible with them, since it acknowledged that a surplus of outputs over inputs was only possible because of the exploitation of the observable productivity of land—which as we now know is the consequence of plants absorbing solar energy.

In this paper, we introduce a production function that is consistent with the Laws of Thermodynamics, and which acknowledges that production without energy is impossible. We start by exploring how the fundamental role of energy in production came to be lost from economics for almost a quarter of a millennium.

Energy and the Physiocrats

Energy was not explicitly mentioned by the Physiocrats as the source of production, for the simple reason that the word itself was only introduced into the language of science by Thomas Young in 1807—well after their School had ceased to exist:

Hence is derived the idea conveyed by the term living or ascending force; for since the height to which a body will rise perpendicularly, is as the square of its velocity, it will preserve a tendency to rise to a height which is as the square of its velocity ... *The same idea is somewhat more concisely expressed by the term energy*, which indicates the tendency of a body to ascend or to penetrate to a certain distance, in opposition to a retarding force." Emphasis added. (Young 1807, p. 34. Emphasis added)

The starting point of Physiocratic thought was the proposition that a "net product" was possible only because the Husbandman exploited "this superfluity that nature accords him as a pure gift" (Turgot 1774, p. 9). Their insight (and its limitations as well) sprang from the fact that the primary raw materials and products of agriculture are identical—seed corn generates a corn plant containing many more corn seeds than were planted:

Land aided by human labor, naturally produces 4, 10, 20, 50, 100, 150 times the amount of wheat sown, depending on the fertility of the soil and the industry of the inhabitants. (Cantillon 1755, p. 170)

At the same time, not all that was harvested could be consumed, so there while outputs exceeded inputs, there was a necessary sense in which less than was produced was available as the net product:

Today, land in Europe yields on the average six times what is sown, so that five times the seed remains for the consumption of the people. (Cantillon 1755, p. 87)

The flaw in the Physiocratic perception was that, while they realized that non-agricultural manufacturing inputs were needed to enable "Husbandmen" to harvest the surplus the land generated, manufacturing was not seen as productive in itself. The fact that manufacturing was also driven by "this superfluity that nature accords him as a pure gift" was obscured by the fact that the outputs of manufacturing (from wheat and lace to wooden and metal products) differed in kind from the inputs. Inputs were raw materials derived from nature, as well as intermediate products and energy in the form of both labor and solar-derived energy from (at that time) windmills, water wheels, wood and coal; outputs were qualitatively incommensurable elaborately transformed products (plus material waste). Consequently, in the most famous Physiocratic work, Quesnay's *Tableau Economique*, manufacturing was shown as "sterile". Though it was vital in enabling the productive class of Husbandmen to extract a surplus or "produit net" from the soil, Quesnay labelled expenditure on manufacturing as "sterile" in the belief that it did not generate a surplus itself, whereas agriculture did (see Figure 1).

Figure 1: An English translation of Quesnay's Tableau Economique (Quesnay 1759)



Land therefore had the primary role, in Physiocratic economics, of generating a surplus. The role of labor was to convert that surplus into different forms, but not to create that surplus in the first instance. The valuation of labor itself was reduced to the amount of land needed to sustain it:

"Land provides the matter, and labor the form, of all commodities and merchandise, and as those who work must subsist on the production of the land, it seems that some par value or ratio between labor and the production of the land might be found." (Cantillon 1755, p. 56)

By these examples, and others of the same sort that could be added, it is seen that the value of the day's work has a relation to the product of the soil. The intrinsic value of any thing may be measured by the quantity of land used in its production and the quantity of labor which enters into it, that is to say, by the quantity of land of which the product is allotted to the laborers." (Cantillon 1755, p. 64)

How energy was lost from economics

Despite meeting Turgot and Quesnay while travelling in France (as a tutor to the Duke of Buccleuch) and being impressed by Physiocratic thought, Adam Smith completely abandoned their perspective

that land was the source of wealth. He argued, to the contrary, that labor was the cause of wealth, and that "division of labor" was the cause of increase in wealth:

THE annual labor of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes, and which consist always, either in the immediate produce of that labor, or in what is purchased with that produce from other nations. (Smith 1776, p. 10)

Smith entertained arguments that gave agriculture a superior role to manufacturing, and attributed non-labor inputs—including both Nature and "laboring cattle"—as potential sources of surplus:

No equal capital puts into motion a greater quantity of productive labor than that of the farmer. Not only his laboring servants, but his laboring cattle, are productive laborers. In agriculture, too, Nature labors along with man; and though her labor costs no expense, its produce has its value, as well as that of the most expensive workmen...

The laborers and laboring cattle, therefore, employed in agriculture, not only occasion, like the workmen in manufactures, the reproduction of a value equal to their own consumption, or to the capital which employs them, together with their owner's profits, but of a much greater value. Over and above the capital of the farmer and all its profits, they regularly occasion the reproduction of the rent of the landlord. This rent may be considered as the produce of those powers of Nature, the use of which the landlord lends to the farmer. (Smith 1776, pp. 283-4)

Despite these snippets, via Ricardo and ultimately Marx, the Classical School became identified with the assertion that labor was the *only* source of a surplus of outputs over inputs. Marx derived his conclusion in two ways: one which focused upon the factors that were unique to labor, and a second which was based on properties that, in Marx's analysis, labor shared with all other commodities (Marx 1857 [1993]; Keen 1993).

The former method distinguished between the capacity of labor to perform work, which Marx called labor, and the means of subsistence which Marx called labor-power, and which he identified with the minimum wage:

The worker receives means of subsistence in exchange for his labor-power, but the capitalist receives in exchange for his means of subsistence labor, the productive activity of the worker, the creative power whereby the worker not only replaces what he consumes *but gives to the accumulated labor a greater value than it previously possessed*. (Marx 1847, p. 85)

The latter method argued that the surplus from labor emanated the difference between the usevalue of labor and its exchange-value::

> The past labor that is embodied in the labor power, and the living labor that it can call into action; the daily cost of maintaining it, and its daily expenditure in work, are two totally different things. The former determines the exchange value of the labor power, the latter is its usevalue. The fact that half a [working] day's labor is necessary to keep the

laborer alive during 24 hours, does not in any way prevent him from working a whole day. Therefore, the value of labor power, and the value which that labor power creates in the labor process, are two entirely different magnitudes; and this difference of the two values was what the capitalist had in view, when he was purchasing the labor power...

What really influenced him was the specific use-value which this commodity possesses of being a source not only of value, but of more value than it has itself. This is the special service that the capitalist expects from labor power, and in this transaction he acts in accordance with the 'eternal laws' of the exchange of commodities. *The seller of labor power*, *like the seller of any other commodity, realises its exchange value, and parts with its use-value.*" (Marx 1867, p. 188. Emphasis added)

However, with respect to machinery, Marx argued that capital does not produce a surplus, but simply imparts to the product the value that it lost in depreciation:

However useful a given kind of raw material, or a machine, or other means of production may be, though it may cost £150...yet it cannot, under any circumstances, add to the value of the product more than £150" (Marx 1867, p. 199)

This led to Marx's mathematical formulations for value production which attributed the generation of a surplus of outputs over to inputs solely to labor: the value of labor-power (v, effectively a subsistence wage),¹ the value imparted to a product by a worker (v+s), the rate of surplus value (s/v), the value of machinery in production (c, effectively its depreciation during use) the value the machine imparts to a product (also c), and the rate of profit (s/(c+v)), and the "organic composition of capital (c/v).

Writing long after the concept of energy had been developed, Marx did link energy to the value of labor power, and the production of surplus value by labor to its consumption and processing of that energy:

Creation of value is transformation of labor-power into labor. *Labor-power itself is energy transferred to a human organism by means of nourishing matter*. (Marx 1867, Chapter 9, Footnote 2. Emphasis added)

Marx and Engels were also aware of the concept of energy and the very early work on the Laws of Thermodynamics (Burkett and Foster 2006). However, the role of energy in production was not explicitly recognised in their mathematical concepts of value.

Marx used Classical Economics to critique capitalism and advocate socialism (rather than, as did Smith and Ricardo, to champion capitalism over feudalism). This played a role in the decline of the Classical School and the rise of the Neoclassical. In Neoclassical economics, labor and capital are

¹ Whenever Marx considered the relationship between the wage and the value of labor-power, the term he used was not "average", but "minimum". In a section of the Grundrisse entitled "The minimum of wages", Marx made it clear that in his complete analysis, the wage would normally exceed the value of labor-power: "For the time being, necessary labor supposed as such; i.e. that the worker always obtains only the minimum of wages. This supposition is necessary, of course, so as to establish the laws of profit insofar as they are not determined by the rise and fall of wages or by the influence of landed property. All these fixed suppositions themselves become fluid in the further course of development." (Marx 1857, p. 817.)

treated, both as creating output, and as sharing in the distribution of income from that output, via the marginal productivity theory of production and distribution.

The archetypical representation of this joint theory of production and distribution is the Cobb-Douglas production function (Cobb and Douglas 1928). In contrast to the Classical school, the production of output was seen as a joint function of the two inputs (capital and labor) while, at the same time, the concept of a surplus of outputs over inputs became invisible.

Describing the actual production system as *P* and their model of it as *P'*, Cobb and Douglas stated that:

it is possible to apply mathematical analysis to the fictitious production P' but not to the actual production P unless we make (or conceal) certain further assumptions. Let us choose the following assumptions and let their justification rest on what we deduce from them:

- (A) The Physical Volume of Production is proportional to the Volume of Production due to manufacturing alone.
- (B) Any departure of *P* from *P'* may be represented by a change in the value of the coefficient of $L^{3/4}C^{1/4}$ so that always

$$P = b \cdot L^{3/4} C^{1/4}$$

where the value of b is independent of the value of L and C. (Cobb and Douglas 1928, p. 155)

Their deductions were that:

- I. The marginal productivity of labor is ³/₄ P/L.
- II. The marginal productivity of capital is $\frac{1}{4}$ P/C.
- III. The productivity of total labor is ³/₄ P.
- IV. The total productivity of capital is ¼ P.

This imputes three-fourths of the product to labor and one-fourth to capital for the period in question.

- V. The elasticity of the product with respect to small changes in labor alone is $\frac{3}{4}$.
- VI. The elasticity of the product with respect to small changes in capital alone is $\frac{3}{4}$.

This means that a small percentage change in labor alone has three times the effect that would be made by the same small percentage change in capital alone. (Cobb and Douglas 1928, pp. 155-6)

Cobb and Douglas did acknowledge that it would be desirable to include natural resources in the production function:

we should ultimately look forward to including the third factor of natural resources in our equations and of seeing to what degree this modifies our conclusions and what light it throws upon the laws of rent. (Cobb and Douglas 1928, p. 165)

However, while other factors were introduced—such as time as a proxy for technological change (Solow 1956; Solow 1957) positive externalities from endogenous technical change (Romer 1990) and human capital (Mankiw, Romer et al. 1992; Mankiw, Phelps et al. 1995)—both natural resources and energy remained absent from what remains, despite logical criticisms (Shaikh 1974; McCombie 2000; Felipe and McCombie 2007), the canonical Neoclassical model of production: the Cobb-Douglas Production Function with neutral technical change (A(t)) and constant returns to scale in the two factors of production Labor (L(t)) and Capital (K(t)):

$$Y = A \cdot K^{\alpha} \cdot L^{1-\alpha} \tag{0.1}$$

The absence of real (material) resource flows and transformations in mainstream economic theory was first pointed out by Kenneth Boulding (Boulding, 1950, 1964, 1966). (Boulding 1945; Boulding 1973; Boulding 1992). Aptly living in Colorado, it was also Boulding who pointed out that the "cowboy economy"—where natural resources were effectively unlimited—was likely to be replaced by the "spaceship economy" where physical resources would become an absolute constraint (Boulding 1987; Boulding 1992). But work on developing a production function in which energy played a pivotal role fell predominantly to researchers whose training was in fields other than economics.

Bringing energy back into economics

Georgescu-Roegen (Georgescu-Roegen 1979) was the first to propose a formula to include natural resources in a production function, by adding them to the standard Cobb-Douglas function (Georgescu-Roegen 1979, p. 17):

$$Q = K^{\alpha} \cdot H^{\beta} \cdot R^{\gamma}, \alpha + \beta + \gamma = 1$$
$$(0.2)^{2}$$

However, he observed a weakness with this formula, in that it implies that output could still be positive with virtually zero input of resources:

With this formula, one easily shows that *Q* may be sustained with *H* constant and with as little *R* as one may wish, provided *K* is sufficiently large. The argument obviously ignores the fact that an increased *K* requires an increased amount of natural resources for producing the additional capital and for maintaining the entire capital stock. (Georgescu-Roegen 1979, p. 17)

Since Georgescu-Roegen (Georgescu-Roegen 1970; Georgescu-Roegen 1975; Georgescu-Roegen 1979; Georgescu-Roegen 1990; Georgescu-Roegen 1999; Georgescu-Roegen 2003), researchers who have made the major contributions to incorporating energy into production functions include Ayres, Costanza, Hannon, Joyce, Kummel, Lindenberger, van den Bergh, Voudouris and Warr (Ayres and Kneese 1969; Hannon 1975; Ayres 1978; Hannon, Costanza et al. 1986; Ayres 1995; Costanza, d'Arg

² In Roegen's notation Q is real output, K capital, H labor and R is natural resources.

et al. 1997; Kummel 2011; Lindenberger and Kümmel 2011; Ayres and Voudouris 2014; Kümmel, Lindenberger et al. 2015).

The link between energy consumption and economic growth was first broached by the geographer Hannon and his student Joyce (Hannon and Joyce 1981). They introduced energy as a third factor of production, and allowed positive returns to scale.

Hannon and colleagues also extended the Leontief Input-Output model to reflect the inter-sectoral flows of energy, and carried out a series of interesting impact analyses (Hannon, 2010). Kummel, a theoretical physicist, conceived of the economy in thermodynamic terms, and argued for including energy *E* (based on conventional IEA energy statistics) as a third factor of production (Kuemmel, 1989; Kuemmel, Lindenberger, & Eichhorn, 2000; Kuemmel, Strassl, Gossner, & Eichhorn, 1985).

In that work Kummel et al introduced an explicit production function, including capital *K*, labor *L* and energy *E* (known as the *LinEx* production function) as an alternative to the traditional two factor production functions (Cobb-Douglas and CES) used by Neoclassical economic modelers. It is equivalent to Georgescu-Roegen's formula with an initial level of output *Y*₀ and energy *E* taking the place of natural resources:

$$Y = Y_0 \cdot K^{\alpha} \cdot L^{\beta} \cdot E^{1-\alpha-\beta}$$

= $Y_0 \cdot E \cdot \left(\frac{K}{E}\right)^{\alpha} \cdot \left(\frac{L}{E}\right)^{\beta}$ (0.3)

Definition of parameters *a* (representing capital efficiency) and *c* (representing the energy demands of the capital stock when fully utilized) led to the *LinEx* form—so-called because it was linear in energy and exponential in the form of the parameters and input ratios:

$$Y = Y_0 \cdot E \cdot e^{\left(a \cdot \left(2 - \frac{L+E}{K}\right) + a \cdot c \cdot \left(\frac{L}{E} - 1\right)\right)}$$
(0.4)

The Kummel version of the LINEX production function yielded very good fits between the model and growth data for Germany, the UK and the US for periods of several decades. The results showed that the output elasticity of energy *E* was larger than the cost share (and larger than the output elasticity of labor, *L*), contradicting the standard textbook cost-share theorem that the output elasticity of a factor of production must be equal to its cost share in the GDP. Kuemmel et al proved mathematically that the output elasticity of energy, as a factor of production, can be larger than its cost share. It followed that energy was much more important as a factor of production than neoclassical economic growth theory assumed.

A modification of Kuemmel's LINEX model, whereby energy is replaced by "useful work" U (in the thermodynamic sense) was introduced (Ayres & Warr, 2005, 2009). The most significant output of that work was to explain the Solow residual quite well for the US, by means of a *LinEx* model covering the entire 20th century, using only two parameters. Again, the output elasticity of work *U* was greater than the cost share (an improved version, bringing the model up to date and taking into account ICT capital explicitly, uses four factors but only three parameters (Warr & Ayres, 2012).

A production function in which energy is essential

However, the weakness noted by Georgescu-Roegen—that production can hypothetically occur with little or no energy input, given appropriate values for L, K and exponents (Georgescu-Roegen 1979, p. 17) —applies to all the production function alternatives noted above. Economics still requires a

production function that acknowledges the essential role of energy, since though economics cannot be reduced to applied thermodynamics (Anderson 1972), it also cannot be incompatible with the Laws of Thermodynamics without, as Eddington put it, having no choice but "to collapse in deepest humiliation":

> "If someone points out to you that your pet theory of the universe is in disagreement with Maxwell's equations then so much the worse for Maxwell's equations. If it is found to be contradicted by observations well, these experimentalists do bungle things sometimes. But if your theory is found to be against the second law of thermodynamics I can give you no hope; there is nothing for it but to collapse in deepest humiliation." (Eddington 1928, p.37)

An equation in which energy plays an essential role, and which is compatible with the Laws of Thermodynamics, can easily be derived by observing that the very idea of either labor or capital without energy is an impossibility. *Labor without energy is a corpse; Capital without energy is a sculpture*. Instead, labor and capital are means by which available energy³ is harnessed to generate output, which in its essence is useful work.

$$Y(E) = F(L(E), K(E))$$
(0.5)

The amount of energy which is actually converted by labor and capital into useful work depends on two factors: the energy required for the maintenance and reproduction of both labor and capital; and the efficiency with which the remaining available energy (known as Exergy) is applied to do work.⁴ Denoting the energy consumed per year by labor and machinery as E_L and E_K respectively, the exergy made available as Ex_L and Ex_K , and the efficiency with which this exergy is employed as e_L and e_K , we have:

$$Y(E) = F\left(L \cdot E_L \cdot \frac{Ex_L}{E_L} \cdot e_L, K \cdot E_K \cdot \frac{Ex_K}{E_K} \cdot e_K\right)$$
(0.6)

Where L stands for units of unskilled labor and K stands for "units" of homogeneous capital (on which see Harcourt 1972 but also see below). Putting this in Cobb-Douglas form with constant returns to scale yields:

$$Y = A \cdot \left(K \cdot E_K \cdot \frac{Ex_K}{E_K} \cdot e_K \right)^{\alpha} \cdot \left(L \cdot E_L \cdot \frac{Ex_L}{E_L} \cdot e_L \right)^{1-\alpha}$$
(0.7)

Dispensing with the now superfluous A term, this yields Equation (0.8) where the first two terms are the capital and labor inputs as in the standard CDPF, and the last two represent the energy harnessed by capital and labor respectively.

³ And raw materials, as noted in our conclusion.

⁴ We could collapse these two terms into one, but feel that it is preferable to separate them. In the case of an automobile for example, the former term would indicate the maximum efficiency with which a car converts energy into movement (including its cost of maintenance); the latter reflects how much of this efficiency can be exploited, given traffic and road conditions, compared to an (impossible but reference) ideal of completely frictionless transport of the car's cargo from origin to destination.

$$Y = K^{\alpha} \cdot L^{1-\alpha} \cdot \left(E_K \cdot \frac{Ex_K}{E_K} \cdot e_K \right)^{\alpha} \cdot \left(E_L \cdot \frac{Ex_L}{E_L} \cdot e_L \right)^{1-\alpha}$$
(0.8)

This equation can be expressed in several different ways, depending on the topic being considered. In economic modelling, the ratios of exergy to energy can be defined $x_L = Ex_L/E_L < 1$ and $x_K = Ex_K/E_K < 1$ to yield:

$$Y = \left(K^{\alpha} \cdot L^{1-\alpha}\right) \cdot \left(E_{L} \cdot x_{L} \cdot e_{L}\right)^{1-\alpha} \cdot \left(E_{K} \cdot x_{K} \cdot e_{K}\right)^{\alpha}$$
(0.9)

Expressed this way, the explanation for the "Solow Residual" is obvious: it is the increasing capacity over time of machines to harness energy. Improving technology has of course been essential to that increased capacity, but that technology itself has depended on increasing levels of energy throughout to achieve the measured increase in useful work per person over time.

In contrast, the energy input E_L per unit of labor L obviously has a maximum, and the energy output per unit of unskilled labor can be treated as constant over time. The energy input E_K per unit of "capital" K—which of course is an aggregate term for numerous different units of specialized machinery in different industries—and its exergy output, on the other hand, have risen from low levels in the machinery of the early Industrial Revolution to extremely high levels for advanced machinery today—and it will undoubtedly grow further in future.

Equation (0.9) recognises the necessary link between energy and machinery that Georgescu-Roegen noted was absent from his equation (0.2), but the separation of the "quantity" of capital from the amount of energy implies that one could have a very large quantity of capital processing a very small amount of energy. Of course, one cannot. The concept of a composite entity called capital is also highly problematic and subject to severe measurement problems (Sraffa 1960; Samuelson 1966; Harcourt 1972). However, these problems can be eliminated if the product $K \cdot E_K$ is replaced by $E_K = K \cdot E_K$, where E_K represents the energy usage. We thus replace two unknown but related

quantities with one well-defined quantity for which time series exist for many countries (see for example

<u>http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.USE.PCAP.KG.OE&country</u>=, which provides data on per capita energy use in kg of oil equivalent). We therefore propose Equation (0.10), which we use in a preliminary empirical examination below:

$$Y = \left(\mathbf{E}_{K} \cdot \mathbf{x}_{K} \cdot \mathbf{e}_{K}\right)^{\alpha} \cdot \left(L \cdot \mathbf{E}_{L} \cdot \mathbf{x}_{L} \cdot \mathbf{e}_{L}\right)^{1-\alpha} 5 \tag{0.10}$$

Preliminary fitting to data

Since the data is in per capita form, Equation (0.10) needs to be converted to GDP per capita. Defining N as the population, and $\Lambda = (E_L \cdot x_L \cdot e_L)^{1-\alpha}$ as the energy contribution of a unit of labor⁶,

 $Y = (Ex_{K} \cdot e_{K})^{\alpha} \cdot (L \cdot E_{L} \cdot x_{L} \cdot e_{L})^{1-\alpha}$ can also be used.

⁵ Alternately, there are some limited time series for exergy, in which case

⁶ The function of labor engaged directly in manufacturing today is predominantly to control machinery, rather than to directly impart its energy to the product.

we now have what we have christened the Energy-Aware Cobb-Douglas Production Function (EACDPF):

$$\frac{Y}{N} = \Lambda \cdot \lambda^{1-\alpha} \cdot \left(\frac{\mathbf{E}_{K}}{N}\right)^{\alpha} \cdot \left(x_{K} \cdot \boldsymbol{e}_{K}\right)^{\alpha}$$
(0.11)

The exergy/energy ratio and efficiency terms for capital are clearly variable over time, but unfortunately must be ignored in this examination since we do not have data for them.

In GDP per capita form, the standard Cobb-Douglas Production Function (CDPF) is Equation (0.12):

$$\frac{Y}{N} = A \cdot \lambda^{1-\alpha} \cdot \left(\frac{K}{N}\right)^{\alpha} \tag{0.12}$$

We perform a simple regression of the change GDP per capita in the USA (Figure 2) against Equations (0.13) (where data is not available for \hat{x}_{K} and \hat{e}_{K}) and (0.14):

$$\widehat{Y}_{PC} = (1 - \alpha) \cdot \widehat{\lambda} + \alpha \cdot \widehat{E}_{PC} + \alpha \cdot (\widehat{x}_{K} + \widehat{e}_{K})$$
(0.13)

$$\widehat{Y}_{PC} = (1 - \alpha) \cdot \widehat{\lambda} + \alpha \cdot \widehat{K}_{PC}$$
(0.14)

Figure 2:US GDP per capita in 2009 dollars



Both equations include the employment rate (Figure 3), which trended up from 1950 till 2000 and has since trended down.

Figure 3: US Employment to Population Ratio



The different inputs to the equations for which data exist are the imputed level of capital stock per person (Figure 4) and the recorded energy consumption per person (Figure 5)

Figure 4: US Capital Stock to Population Index



While imputed capital per head is shown as rising continuously, recorded energy usage per head has been much more volatile, rising rapidly from 1960 till 1973, then falling, rising and falling sharply once more over the periods of OPEC I and OPEC II (the two fourfold increases in the oil price per barrel in 1973/4 and 1989/90 respectively). Since then, a slight rise in per capita energy consumption terminated in 2000, leading to a fall in energy consumption that resulted in energy consumption per head falling to mid-1960s levels by 2015. These extreme swings in total energy consumption per capita involve substantial changes (generally improvements) in the exergy/energy and efficiency of exergy usage by capital components of Equation (0.9), for which data is not available.

Capital Stock to Population Ratio USA

Figure 5: US Energy use per head



Though the capital stock and energy per head data series are very different, their changes are moderately correlated—see Figure 6.

Figure 6: Percentage rates of change of capital stock and energy per head variables



Despite the absence of critical exergy-energy and efficiency data, the Energy-Augmented Cobb-Douglas Production Function performs notably better than the standard Cobb-Douglas Production Function. The correlation coefficient of Equation (0.13) is 0.81; the correlation coefficient of Equation (0.14) is 0.73.⁷

⁷ The highest correlation coefficient for both equations was found with α =0.25, as was the case with the original research by Cobb and Douglas.

Figure 7: Correlation of changes in real GDP per head to changes in employment rate and capital per head



Figure 8: Correlation of changes in real GDP per head to changes in employment rate and energy per head



Evaluating existing production functions

This Energy-Augmented CDPF fulfils an ambition that Cobb and Douglas expressed, of "including the third factor of natural resources in our equations and of seeing to what degree this modifies our conclusions and what light it throws upon the laws of rent" (Cobb and Douglas 1928, p. 165). The EACDPF clearly extends Cobb and Douglas's work by making it compatible with the Laws of Thermodynamics, which is essential if a production function is to be taken seriously at all as a description of the physical process of production, as Eddington so emphatically put it (Eddington 1928).

However, many of the implications which have been customarily drawn from the CDPF can no longer be supported. The primary casualty here is the implicit link between the CDPF and the marginal productivity theory of income distribution. Numerically, the marginal contribution of labor to production in Equation (0.9) reduces to the exergy contribution of a single worker, which is of the order of 1000 calories per day: clearly the wage far exceeds this value. Epistemologically, the very concept of the marginal productivity of labor and capital in the absence of energy no longer makes sense: instead both factors are means to harness available energy, and it is the change in the amount of energy they harness that is the true source of a change in the level of output—but energy per se does not receive a payment.

In this light, the distribution of income does not reflect the marginal productivity of the inputs, but is instead reflective of the ability of labor and the owners of machinery to bargain over the allocation of the surplus generated in production by harnessing the energy we find on this open system we call Planet Earth.

This has both positive and negative consequences for a perennial of economic debate, the question of whether or not labor is "exploited" by capital. The initial negative—at least for customary debate—is that the argument that the wage is the marginal product of labor, and therefore no exploitation is occurring, must be dispensed with. The positive however is that, since the wage is far higher than labor's marginal productivity, clearly it cannot be argued that labor is being exploited by capital. But nor can it be argued that labor "exploits" capital. Instead, both labor and capital—where the latter is properly defined in this context as the owners of machinery, rather than the machinery itself—exploit the energy that the collective functioning of labor and machinery are able to convert into useful work.

The Marxist proposition that all surplus comes from labor, and its corollary that a machine adds nothing to production beyond its own depreciation ("However useful a given kind of raw material, or a machine, or other means of production may be, though it may cost £150...yet it cannot, under any circumstances, add to the value of the product more than £150", Marx 1867) can also be dispensed with. These propositions, put into the form of Equation (0.8), equate Marx's concept of the rate of surplus value s/v to the Exergy/Energy ratio for labor, and argue that the exergy contribution of machinery to production is zero:

$$Y = K^{\alpha} \cdot L^{1-\alpha} \cdot \left(E_K \cdot \frac{0}{E_K} \cdot e_K \right)^{\alpha} \cdot \left(v \cdot \frac{s}{v} \cdot e_L \right)^{1-\alpha}$$
(0.15)

The only way this can be shown to produce non-zero output at all is if the α exponent is set to zero, yielding:

$$Y = L \cdot s \cdot e_L \tag{0.16}$$

This in turn implies that income per capita is of the order of 1000 calories per day, which is an empirical absurdity to add to the logical absurdities that have bedevilled the Labor Theory of Value since its inception (Böhm-Bawerk 1896; Steedman 1977; Keen 1993).

Post-Keynesian production theory fares rather better than both Neoclassical and Marxist theories. Post-Keynesian modellers generally use production functions where output is the minimum of either a capital to output ratio, or an output to labor ratio, where the latter applies if capacity utilization u_{κ} is below its maximum level:

$$Y = \min\left(\frac{K}{v}, a \cdot L\right) \tag{0.17}$$

In place of the Neoclassical presumption of smooth factor substitutability, Post Keynesian theory argues for an inflexible (though variable over the long term) ratio *a* between utilized machinery and labor:

$$Y = u_K \cdot \frac{K}{v} = a \cdot L \tag{0.18}$$

This approach can be made energy-aware by acknowledging that output is proportional to the exergy output of machinery, while employment is proportional to output, and the energy input to machinery has grown exponentially over time:

$$Y(E_{\kappa}) = u_{\kappa} \cdot E_{\kappa} \cdot x_{\kappa} \cdot e_{\kappa}$$

$$(= u_{\kappa} \cdot K \cdot E_{\kappa} \cdot x_{\kappa} \cdot e_{\kappa})$$

$$L = a \cdot Y(E_{\kappa})$$

$$E_{\kappa}(t) = E_{0} \cdot e^{\alpha \cdot t}$$
(0.19)

The role of energy can also be expressed in a Sraffa-Leontief style production function, with the energy inputs for labor and commodity inputs shown separately: this is more realistic than the *EACDPF* form, and could also provide some closure on the Capital Controversies debates (Sraffa 1960, Samuelson 1966, Pasinetti 2000, Pasinetti, Fisher et al. 2003, Pasinetti 2005), since while machinery is clearly heterogeneous, from this energy-aware perspective, all machines have a homogenous purpose—to turn energy into useful work—and in our electric-power-dominated production system, most machines have a homogeneous energy input as well.

Conclusion and Future Work

This energy-aware production function has many more implications than can be explored in this preliminary note. The equation is clearly compatible with the Laws of Thermodynamics, since as well as acknowledging that production without energy is impossible, energy embodied in useful work is clearly less than the total energy inputs. It can be expanded to include the role of raw materials as distinct from energy in production. And it provides a clear link between economics and ecology.

Crucially, it forces us to perceive the roles of both capital and labor with respect to energy as the Physiocrats once perceived the role of Husbandmen with respect to the land, as the means by which the we harvest "that independent and disposable part, which the earth produces as a free gift to the proprietor over and above what he has disbursed", out of which "he is enabled to live without labor, and which he can carry wherever he will" (Turgot 1774, pp. 15-16).

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1961.166 17064.71 0.555 109.3227 5628.534 8.06% 0.13% -1.71% 1.08% 1961.25 17151.92 0.556 109.6323 5638.814 7.62% 0.45% -0.88% 2.18% 1961.31 17308.92 0.552 110.0699 5662.971 6.45% 1.08% 0.38% 0.02% 1961.65 17376.97 0.556 110.374 5691.243 5.08% 1.67% 1.32% -0.07% 1961.56 1735.29 0.553 110.4341 5706.664 3.38% 1.95% 2.32% 0.03% 1961.75 17629.83 0.55 110.502 572.817 3.72% 2.22% 3.54% -0.93% 1961.91 17824.01 0.555 110.703 5765.878 2.59% 2.69% 5.43% -0.15% 1962.166 18035.22 0.557 111.1413 5810.869 1.66% 3.24% 5.69% 0.69% 1962.216 18035.92 0.557 111.388 5829.267 1.56% 3.38% 5.38% 0.52% 1962.53 1819.304	1961.083	16986	0.557	108.9381	5619.589	8.35%	-0.20%	-2.27%	1.69%
1961.25 17151.92 0.556 109.6323 5638.814 7.62% 0.45% -0.88% 2.18% 1961.333 17236 0.552 109.8777 5650.327 7.07% 0.77% -0.10% 0.17% 1961.416 17308.92 0.552 110.0699 5662.971 6.45% 1.03% 0.38% 0.02% 1961.583 17450 0.552 110.3374 5691.243 5.08% 1.67% 1.32% -0.07% 1961.666 17535.29 0.553 110.4341 5706.668 4.38% 1.95% 2.32% 0.03% 1961.833 17728 0.555 110.703 5768.878 2.59% 2.69% 5.43% -0.93% 1961.916 17824.01 0.555 110.800 574.586 2.17% 2.90% 5.81% 0.00% 1962.261 18035.22 0.557 111.1413 5810.869 1.66% 3.24% 5.69% 0.69% 1962.251 18075.19 0.557 111.388 5829.267 1.56% 3.38% 5.38% 0.52% 1962.466 18214.41 <	1961.166	17064.71	0.555	109.3227	5628.534	8.06%	0.13%	-1.71%	1.08%
1961.333 17236 0.552 109.8777 5650.327 7.07% 0.77% -0.10% 0.17% 1961.416 17308.92 0.552 110.0699 5662.971 6.45% 1.08% 0.38% 0.02% 1961.58 17476 0.556 110.2195 5676.643 5.77% 1.38% 0.74% 0.25% 1961.666 17535.29 0.553 110.4341 5706.668 4.38% 1.95% 2.32% 0.03% 1961.813 17728 0.553 110.604 5739.588 3.12% 2.46% 4.66% 0.11% 1961.91 1782.401 0.555 110.8026 5774.586 2.17% 2.90% 5.81% 0.00% 1962.083 17983 0.557 111.30672 572.613 1.86% 3.08% 5.87% 0.66% 1962.166 18035.22 0.557 111.313 8810.809 1.66% 3.28% 5.69% 0.69% 1962.51 1807.19 0.557 111.7892 5866.136 1.56% 3.58% 1.02% 1962.53 18193.04 0.556 112.2	1961.25	17151.92	0.556	109.6323	5638.814	7.62%	0.45%	-0.88%	2.18%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1961.333	17236	0.552	109.8777	5650.327	7.07%	0.77%	-0.10%	0.17%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1961.416	17308.92	0.552	110.0699	5662.971	6.45%	1.08%	0.38%	0.02%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1961.5	17376.97	0.556	110.2195	5676.643	5.77%	1.38%	0.74%	0.25%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1961.583	17450	0.552	110.3374	5691.243	5.08%	1.67%	1.32%	-0.07%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1961 666	17535 29	0.553	110 4341	5706 668	4 38%	1 95%	2 32%	0.03%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1961 75	17629.83	0.55	110 5202	5722 817	3 72%	2 22%	3 54%	-0.93%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1961 833	17728	0 553	110 6064	5739 588	3 12%	2 46%	4 66%	0.00%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1961 916	17824 01	0.555	110 703	5756 878	2 59%	2 69%	5 43%	-0 15%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1962	17911 27	0.553	110 8206	5774 586	2 17%	2 90%	5 81%	0.00%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1962.083	17983	0.554	110.9672	5792.613	1.86%	3.08%	5.87%	0.06%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1962 166	18035 22	0.557	111 1413	5810 869	1.66%	3 24%	5 69%	0.69%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1962 25	18075 19	0.557	111 3388	5829 267	1.56%	3 38%	5 38%	0.52%
1962.416 1815.05 0.557 111.7892 5866.136 1.56% 3.59% 4.89% 1.07% 1962.5 18193.04 0.556 112.0343 5884.433 1.65% 3.66% 4.70% 0.41% 1962.583 18215 0.553 112.2876 5902.522 1.77% 3.71% 4.38% 0.58% 1962.666 18214.41 0.557 112.5452 5920.315 1.91% 3.74% 3.87% 1.02% 1962.75 18206.51 0.557 112.8034 5937.726 2.07% 3.76% 3.27% 1.47% 1962.916 18245.58 0.552 113.0585 5954.665 2.22% 3.75% 2.37% 0.83% 1963.083 18297.99 0.552 113.7686 6001.813 2.52% 3.61% 2.06% 0.36% 1963.166 18403.65 0.551 113.9839 6016.173 2.56% 3.53% 2.04% -0.17% 1963.25 18458.15 0.553 114.4069 6043.139 2.56% 3.24% 2.02% 0.10% 1963.51 18747.11	1962 333	18113	0.554	111 5561	5847 718	1 53%	3 49%	5 09%	0.65%
1962.518193.040.556112.03435884.4331.65%3.66%4.70%0.41%1962.583182150.553112.28765902.5221.77%3.71%4.38%0.58%1962.66618214.410.557112.54525920.3151.91%3.74%3.87%1.02%1962.7518206.510.557112.80345937.7262.07%3.76%3.27%1.47%1962.833182120.555113.05855954.6652.22%3.75%2.73%0.83%1962.91618245.580.552113.5445986.7842.46%3.67%2.16%0.48%1963.083183540.552113.76866001.8132.52%3.61%2.06%0.36%1963.16618403.650.551113.98396016.1732.56%3.53%2.04%-0.17%1963.2518458.150.553114.40696043.1392.56%3.34%2.32%0.77%1963.41618639.120.553114.62486055.8732.54%3.23%2.67%0.10%1963.583188230.554115.09816080.1582.50%3.01%3.34%0.76%1963.66618845.770.555115.65486103.292.53%2.79%3.54%0.22%1963.7518850.20.555115.65486103.292.53%2.69%3.70%0.65%1963.8318850.555115.97686114.5822.58%2.69%3.70%0.65% <tr<< td=""><td>1962.416</td><td>18155.05</td><td>0.557</td><td>111.7892</td><td>5866.136</td><td>1.56%</td><td>3.59%</td><td>4.89%</td><td>1.07%</td></tr<<>	1962.416	18155.05	0.557	111.7892	5866.136	1.56%	3.59%	4.89%	1.07%
1962.58318215 0.553 112.2876 5902.522 1.77% 3.71% 4.38% 0.58% 1962.66618214.41 0.557 112.5452 5920.315 1.91% 3.74% 3.87% 1.02% 1962.7518206.51 0.557 112.8034 5937.726 2.07% 3.76% 3.27% 1.47% 1962.83318212 0.555 113.0585 5954.665 2.22% 3.75% 2.73% 0.83% 1963.91618245.58 0.552 113.3066 5971.047 2.35% 3.72% 2.37% 0.18% 1963.08318354 0.552 113.7686 6001.813 2.52% 3.61% 2.06% 0.36% 1963.16618403.65 0.551 113.9839 6016.173 2.56% 3.53% 2.04% -0.17% 1963.2518458.15 0.553 114.195 6029.927 2.57% 3.44% 2.12% 0.10% 1963.33318534 0.555 114.4069 6043.139 2.56% 3.34% 2.32% 0.77% 1963.41618639.12 0.553 114.6248 6055.873 2.54% 3.23% 2.67% 0.10% 1963.5318823 0.554 115.0981 6080.158 2.50% 3.01% 3.34% 0.22% 1963.7518850.2 0.555 115.6548 6103.29 2.53% 2.79% 3.54% 0.22% 1963.7518850.2 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% <td>1962.5</td> <td>18193.04</td> <td>0.556</td> <td>112.0343</td> <td>5884,433</td> <td>1.65%</td> <td>3.66%</td> <td>4.70%</td> <td>0.41%</td>	1962.5	18193.04	0.556	112.0343	5884,433	1.65%	3.66%	4.70%	0.41%
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1962.583	18215	0.553	112.2876	5902.522	1.77%	3.71%	4.38%	0.58%
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1962.666	18214.41	0.557	112.5452	5920.315	1.91%	3.74%	3.87%	1.02%
1962.83318212 0.555 113.05855954.665 2.22% 3.75% 2.73% 0.83% 1962.91618245.58 0.552 113.30665971.047 2.35% 3.72% 2.37% 0.18% 196318297.99 0.552 113.5445986.784 2.46% 3.67% 2.16% 0.48% 1963.08318354 0.552 113.76866001.813 2.52% 3.61% 2.06% 0.36% 1963.16618403.65 0.551 113.98396016.173 2.56% 3.53% 2.04% -0.17% 1963.2518458.15 0.553 114.195 6029.927 2.57% 3.44% 2.12% 0.10% 1963.33318534 0.555 114.4069 6043.139 2.56% 3.34% 2.32% 0.77% 1963.41618639.12 0.553 114.6248 6055.873 2.54% 3.23% 2.67% 0.10% 1963.58318823 0.554 115.0981 6080.158 2.50% 3.01% 3.34% 0.76% 1963.66618845.77 0.554 115.3636 6091.836 2.50% 2.90% 3.47% 0.22% 1963.7518850.2 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.91618983.12 0.554 116.3344 6125.777 2.67% 2.59% 4.04% 0.94% 196419114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84%	1962.75	18206.51	0.557	112.8034	5937.726	2.07%	3.76%	3.27%	1.47%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1962.833	18212	0.555	113.0585	5954.665	2.22%	3.75%	2.73%	0.83%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1962.916	18245.58	0.552	113.3066	5971.047	2.35%	3.72%	2.37%	0.18%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1963	18297.99	0.552	113.544	5986.784	2.46%	3.67%	2.16%	0.48%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1963.083	18354	0.552	113,7686	6001.813	2.52%	3.61%	2.06%	0.36%
1963.25 18458.15 0.553 114.195 6029.927 2.57% 3.44% 2.12% 0.10% 1963.333 18534 0.555 114.4069 6043.139 2.56% 3.34% 2.32% 0.77% 1963.416 18639.12 0.553 114.6248 6055.873 2.54% 3.23% 2.67% 0.10% 1963.5 18747.11 0.553 114.8535 6068.191 2.52% 3.12% 3.05% 0.22% 1963.666 18845.77 0.554 115.0981 6080.158 2.50% 3.01% 3.34% 0.76% 1963.75 18850.2 0.555 115.6548 6103.29 2.53% 2.79% 3.54% 0.36% 1963.833 1885 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.916 18983.12 0.553 116.7324 6136.938 2.81% 2.51% 4.04% 0.94% 1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 <td>1963,166</td> <td>18403.65</td> <td>0.551</td> <td>113,9839</td> <td>6016.173</td> <td>2.56%</td> <td>3.53%</td> <td>2.04%</td> <td>-0.17%</td>	1963,166	18403.65	0.551	113,9839	6016.173	2.56%	3.53%	2.04%	-0.17%
1963.333 18534 0.555 114.4069 6043.139 2.56% 3.34% 2.32% 0.77% 1963.416 18639.12 0.553 114.6248 6055.873 2.54% 3.23% 2.67% 0.10% 1963.5 18747.11 0.553 114.8535 6068.191 2.52% 3.12% 3.05% 0.22% 1963.583 18823 0.554 115.0981 6080.158 2.50% 3.01% 3.34% 0.76% 1963.666 18845.77 0.554 115.3636 6091.836 2.50% 3.01% 3.47% 0.22% 1963.75 18850.2 0.555 115.6548 6103.29 2.53% 2.79% 3.54% 0.36% 1963.833 18885 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.916 18983.12 0.553 116.7324 6136.938 2.81% 2.51% 4.04% 0.94% 1964 19114.43 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88% 1964.083 19233 0.553 <td>1963.25</td> <td>18458.15</td> <td>0.553</td> <td>114,195</td> <td>6029.927</td> <td>2.57%</td> <td>3.44%</td> <td>2.12%</td> <td>0.10%</td>	1963.25	18458.15	0.553	114,195	6029.927	2.57%	3.44%	2.12%	0.10%
1963.416 18639.12 0.553 114.6248 6055.873 2.54% 3.23% 2.67% 0.10% 1963.5 18747.11 0.553 114.8535 6068.191 2.52% 3.12% 3.05% 0.22% 1963.583 18823 0.554 115.0981 6080.158 2.50% 3.01% 3.34% 0.76% 1963.666 18845.77 0.554 115.3636 6091.836 2.50% 2.90% 3.47% 0.22% 1963.75 18850.2 0.555 115.6548 6103.29 2.53% 2.79% 3.54% 0.36% 1963.833 18885 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.916 18983.12 0.554 116.3344 6125.777 2.67% 2.59% 4.04% 0.94% 1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88%	1963.333	18534	0.555	114,4069	6043,139	2.56%	3.34%	2.32%	0.77%
1963.5 18747.11 0.553 114.8535 6068.191 2.52% 3.12% 3.05% 0.22% 1963.583 18823 0.554 115.0981 6080.158 2.50% 3.01% 3.34% 0.76% 1963.666 18845.77 0.554 115.3636 6091.836 2.50% 2.90% 3.47% 0.22% 1963.75 18850.2 0.555 115.6548 6103.29 2.53% 2.79% 3.54% 0.36% 1963.833 18885 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.916 18983.12 0.554 116.3344 6125.777 2.67% 2.59% 4.04% 0.94% 1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88%	1963 416	18639 12	0.553	114 6248	6055 873	2 54%	3 23%	2 67%	0.10%
1963.583 18823 0.554 115.0981 6080.158 2.50% 3.01% 3.34% 0.76% 1963.666 18845.77 0.554 115.3636 6091.836 2.50% 2.90% 3.47% 0.22% 1963.75 18850.2 0.555 115.6548 6103.29 2.53% 2.79% 3.54% 0.36% 1963.833 18885 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.916 18983.12 0.554 116.3344 6125.777 2.67% 2.59% 4.04% 0.94% 1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88%	1963 5	18747 11	0.553	114 8535	6068 191	2 52%	3 12%	3 05%	0.22%
1963.666 18845.77 0.554 115.3636 6091.836 2.50% 2.90% 3.47% 0.22% 1963.75 18850.2 0.555 115.6548 6103.29 2.53% 2.79% 3.54% 0.36% 1963.833 18885 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.916 18983.12 0.554 116.3344 6125.777 2.67% 2.59% 4.04% 0.94% 1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88%	1963.583	18823	0.554	115.0981	6080.158	2.50%	3.01%	3.34%	0.76%
1963.75 18850.2 0.555 115.6548 6103.29 2.53% 2.79% 3.54% 0.36% 1963.833 18885 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.916 18983.12 0.554 116.3344 6125.777 2.67% 2.59% 4.04% 0.94% 1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88%	1963.666	18845.77	0.554	115,3636	6091.836	2.50%	2.90%	3.47%	0.22%
1963.833 18885 0.555 115.9768 6114.582 2.58% 2.69% 3.70% 0.65% 1963.916 18983.12 0.554 116.3344 6125.777 2.67% 2.59% 4.04% 0.94% 1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88% 1964.166 10205.8 0.556.4 117.6541 6150.488 2.29% 2.244% 4.79% 0.88%	1963.75	18850.2	0.555	115.6548	6103.29	2.53%	2.79%	3.54%	0.36%
1963.916 18983.12 0.554 116.3344 6125.777 2.67% 2.59% 4.04% 0.94% 1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88% 1964.166 10205 0.556 117.6541 6150.48% 2.22% 4.00% 4.40%	1963.833	18885	0.555	115,9768	6114.582	2.58%	2.69%	3.70%	0.65%
1964 19114.43 0.553 116.7324 6136.938 2.81% 2.51% 4.46% 0.84% 1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88% 1964.166 10205 0.556 117.6541 6150.48% 2.23% 2.28% 4.00%	1963.916	18983.12	0.554	116.3344	6125.777	2.67%	2.59%	4.04%	0.94%
1964.083 19233 0.553 117.1739 6148.138 2.99% 2.44% 4.79% 0.88% 1064.166 10205.8 0.556 117.6541 6150.488 2.22% 2.28% 4.00% 4.40%	1964	19114.43	0.553	116.7324	6136.938	2.81%	2.51%	4.46%	0.84%
	1964.083	19233	0.553	117.1739	6148.138	2.99%	2.44%	4.79%	0.88%
1904.100 19303.0 0.330 117.0341 0139.488 3.22% 2.38% 4.90% 1.49%	1964.166	19305.8	0.556	117.6541	6159.488	3.22%	2.38%	4.90%	1.49%

1964.25	19351.34	0.555	118.1661	6171.11	3.48%	2.34%	4.84%	1.14%
1964.333	19401	0.559	118.7034	6183.124	3.76%	2.32%	4.68%	1.48%
1964.416	19475.22	0.561	119.2592	6195.652	4.04%	2.31%	4.49%	2.10%
1964.5	19550.65	0.556	119.8269	6208.814	4.33%	2.32%	4.29%	1.49%
1964.583	19593	0.557	120.3999	6222.731	4.61%	2.34%	4.09%	1.56%
1964.666	19583.32	0.557	120.9717	6237.526	4.86%	2.39%	3.91%	1.62%
1964.75	19564.06	0.557	121.5357	6253.318	5.08%	2.46%	3.79%	1.54%
1964.833	19593	0.556	122.0854	6270.229	5.27%	2.55%	3.75%	1.45%
1964.916	19708.45	0.557	122.6142	6288.379	5.40%	2.65%	3.82%	1.76%
1965	19870.8	0.556	123.1157	6307.89	5.47%	2.79%	3.96%	1.77%
1965.083	20021	0.557	123.585	6328.825	5.47%	2.94%	4.10%	1.91%
1965.166	20115.97	0.557	124.0237	6351.012	5.41%	3.11%	4.20%	1.49%
1965.25	20176.65	0.559	124.4351	6374.223	5.31%	3.29%	4.26%	1.87%
1965.333	20240	0.56	124.8223	6398.227	5.15%	3.48%	4.32%	1.42%
1965.416	20334.32	0.562	125.1884	6422.797	4.97%	3.67%	4.41%	1.38%
1965.5	20453.31	0.561	125.5365	6447.702	4.76%	3.85%	4.62%	1.87%
1965.583	20582	0.565	125.87	6472.713	4.54%	4.02%	5.05%	2.21%
1965.666	20709.97	0.563	126,1917	6497.601	4.32%	4.17%	5.75%	1.89%
1965.75	20844.9	0.562	126.505	6522.137	4.09%	4.30%	6.55%	1.70%
1965.833	20999	0.564	126.8128	6546.092	3.87%	4.40%	7.18%	2.05%
1965,916	21175.81	0.564	127.1182	6569.236	3.67%	4.47%	7.45%	1.86%
1966	21344 11	0.566	127 4244	6591 341	3 50%	4 49%	7 41%	2 22%
1966 083	21464	0.567	127 7338	6612 244	3 36%	4 48%	7 21%	2 19%
1966 166	21508 99	0.566	128 0467	6632 058	3 24%	4 43%	6.92%	2 02%
1966 25	21506 16	0.566	128 3629	6650 962	3 16%	4 34%	6 59%	1 73%
1966 333	21496	0.568	128 6821	6669 136	3 09%	4 23%	6 21%	1.84%
1966.416	21509.98	0.567	129.004	6686.76	3.05%	4.11%	5.78%	1.43%
1966 5	21543 51	0.569	129 3285	6704 014	3 02%	3 98%	5 33%	1.82%
1966 583	21583	0.569	129 6552	6721 076	3 01%	3 84%	4 86%	1 28%
1966 666	21618 53	0.57	129 984	6738 128	3 01%	3 70%	4 39%	1 68%
1966 75	21655.01	0.571	130 3145	6755 349	3 01%	3 58%	3 89%	1.95%
1966 833	21701	0.571	130 6465	6772 918	3.02%	3 47%	3 34%	1.69%
1966 916	21760 1	0.574	130 9798	6791 015	3.04%	3.38%	2 76%	2 09%
1967	21815.9	0.573	131 3141	6809 82	3 05%	3.31%	2 21%	1 69%
1967 083	21847	0.571	131 6492	6829 466	3.07%	3 29%	1 78%	1.30%
1967 166	21840.65	0.57	131 9852	6849 891	3.08%	3 28%	1.54%	1.30%
1967 25	21818 78	0.568	132 322	6870.99	3.08%	3.31%	1.04%	1.00%
1967 333	21812	0.571	132 6598	6892 655	3.09%	3.35%	1.40%	1.04%
1967 416	21841 67	0.57	132 9984	6914 778	3 10%	3 4 1 %	1.47%	1.17%
1967 5	21892.26	0.573	133 338	6937 253	3 10%	3.48%	1.54%	1 30%
1967 583	21002.20	0.573	133 6786	6959 973	3 10%	3 55%	1.65%	1.00%
1967 666	21966 17	0.574	134 0202	6982 829	3 11%	3.63%	1.61%	1 30%
1067 75	21000.17	0.574	134 36202	7005 715	3 11%	3 71%	1.57%	1 17%
1067 833	21994.51	0.575	134 7067	7028 523	3 11%	3 77%	1.57%	1.17 /0
1967.000	22000	0.575	135 0515	7020.323	3 11%	3 83%	1.02 %	0.01%
1907.910	22305.04	0.575	135 3076	7073 479	3 11%	3.00%	2 24%	1 17%
1068 083	22303.04	0.570	135 7446	7005 442	3 11%	3.80%	2.24%	0.65%
1968 166	22586 5	0.57	136 0018	7117 082	3 11%	3 00%	2.70%	1 17%
1968 25	22000.0	0.575	136 / 32	7138 //7/	3 11%	3 80%	1 02%	1.17/0
1068 222	22030.24	0.574	136 7822	7150 60/	3.11%	3 8 70/2	T.UZ/0 1 110/	1 170/
1968 /116	22820 22	0.574	137 122/	7180 819	3 10%	3 85%	7.77/0 1.57%	1.17/0
1068 5	22000.02	0.570	137 / 605	7201 022	3 00%	3 8 2 %	4.57 %	1/13%
1000.0	22012.01	0.070	101.4000	1201.022	0.0070	0.02/0		1. T J /0

1968.583	22883	0.576	137.7924	7223.082	3.08%	3.78%	4.30%	1.03%
1968.666	22877.26	0.575	138.118	7244.373	3.06%	3.75%	4.15%	0.90%
1968.75	22880.64	0.575	138.4364	7265.872	3.03%	3.71%	4.03%	0.89%
1968.833	22923	0.575	138.7465	7287.653	3.00%	3.69%	3.95%	0.75%
1968.916	23021.2	0.576	139.0471	7309.793	2.96%	3.67%	3.88%	0.87%
1969	23139.96	0.577	139.3373	7332.369	2.91%	3.66%	3.74%	0.86%
1969.083	23231	0.576	139.6164	7355.399	2.85%	3.66%	3.46%	1.50%
1969.166	23260.73	0.579	139.8849	7378.683	2.79%	3.68%	2.99%	1.48%
1969.25	23254.4	0.579	140.1437	7401.965	2.72%	3.69%	2.46%	1.33%
1969.333	23252	0.579	140.3938	7424.988	2.64%	3.71%	2.07%	1.31%
1969.416	23281.04	0.578	140.636	7447.495	2.56%	3.71%	1.93%	0.64%
1969.5	23319.27	0.58	140.8714	7469.231	2.48%	3.71%	1.95%	0.88%
1969.583	23332	0.58	141.1006	7489.939	2.40%	3.69%	1.96%	1.12%
1969.666	23295.34	0.581	141.3248	7509.362	2.32%	3.66%	1.83%	1.36%
1969.75	23228.62	0.581	141.5447	7527.243	2.25%	3.60%	1.52%	1.34%
1969.833	23162	0.581	141.7613	7543.327	2.17%	3.51%	1.04%	1.33%
1969 916	23118.2	0.581	141 9754	7557 357	2 11%	3 39%	0.42%	1 18%
1970	23090.31	0.581	142 188	7569 077	2 05%	3 23%	-0.21%	1.03%
1970 083	23064	0.58	142 3999	7578 349	1 99%	3.03%	-0.72%	1.00%
1970 166	23031.67	0 579	142 6118	7585 522	1.00%	2.80%	-0.98%	0.49%
1970.25	23012.65	0.579	142.0110	7591.063	1.00%	2.00%	-1 04%	0.40%
1970 333	23033	0.579	142.0247	7595 437	1.88%	2.00%	-0.94%	0.40%
1970.000	23102 79	0.575	143 2558	7500 113	1.86%	2.00%	-0.77%	0.4770
1070.410	23168 1	0.573	143.4757	7602 558	1.85%	1 70%	-0.65%	-0.44%
1070 583	23100.1	0.573	143.6004	7606 238	1.84%	1.75%	-0.00%	-0.32%
1970.505	23037 24	0.574	143 9277	7610 621	1.84%	1.35%	-0.74%	-0.32 /0
1070.000	20007.24	0.572	140.0277	7616 174	1.85%	1.00%	-1.11%	-0.70%
1070 833	22031.22	0.57	144.1014	7623 365	1.86%	1.10%	-1.40%	0.00%
1970.033	22041	0.57	144.4012	7632.650	1.88%	1.00%	-1.39%	1 0.90%
1070.910	22300.40	0.509	144.0470	7644 525	1.00 /0	1.00%	-0.00%	-1.00/0
1071 092	23100.0	0.507	144.902	7650 304	1.9170	1.00%	0.42 /0	1 07%
1971.005	23301	0.508	145.1044	7039.304	1.94 /0	1.07 /0	1.37 /0	-1.07/0
1071 25	23459.57	0.500	145.435	7606 838	1.90 /0	1.20 /0	1.00 %	-1.19/0
1071 222	23450.95	0.504	145.7157	7090.030	2.02 /0	1.09/0	1.94 /0	-1.44 /0
1971.333	23447	0.500	140.0004	7719.025	2.07%	1.03%	1.60%	-1.1770
1071 5	23474.43	0.500	140.2940	7769 912	2.1270	1.09%	1.01%	-0.04%
197 1.0	23322.97	0.502	140.097	7705.012	2.10%	2.1970	1.00%	-0.90%
1971.003	23007	0.505	140.9000	7790.044	2.23%	2.49%	1.72%	-0.02%
1971.000	23553.49	0.500	147.2237	7023.922	2.29%	2.00%	2.24%	-0.21%
19/1./0	20009.00	0.500	147.040	7002.701	2.33%	3.11% 2.200/	2.03%	
1971.833	23004	0.500	147.8795	7882.076	2.41%	3.39%	3.12%	0.08%
1971.910	23027.74	0.568	148.2179	7911.583	2.47%	3.05%	2.88%	0.49%
1972	23/54.48	0.568	148.5632	7940.998	2.53%	3.88%	2.45%	0.76%
1972.083	23919	0.567	148.915	7970.024	2.58%	4.06%	2.30%	0.51%
1972.166	24103.42	0.567	149.2724	7998.319	2.64%	4.19%	2.74%	0.79%
1972.25	24279.17	0.569	149.6341	8025.533	2.69%	4.27%	3.50%	1.34%
1972.333	24415	0.569	149.9991	8051.312	2.74%	4.30%	4.13%	1.08%
1972.416	24490.97	0.57	150.3661	8075.303	2.78%	4.29%	4.33%	1.23%
19/2.5	24532.42	0.57	150./34	8097.155	2.82%	4.23%	4.29%	1.//%
19/2.583	24576	0.57	151.1016	8116.516	2.86%	4.11%	4.33%	1.38%
19/2.666	24652.14	0.571	151.4679	8133.032	2.88%	3.95%	4.66%	1.38%
1972.75	24766.37	0.57	151.8316	8146.351	2.90%	3.74%	5.21%	1.26%
1972.833	24918	0.57	152.1917	8156.121	2.92%	3.48%	5.79%	1.26%

1972.916	25102.14	0.572	152.5469	8161.989	2.92%	3.17%	6.24%	1.26%
1973	25297.1	0.573	152.8962	8163.604	2.92%	2.80%	6.49%	1.39%
1973.083	25477	0.571	153.2385	8160.72	2.90%	2.39%	6.51%	1.25%
1973.166	25617.46	0.575	153.5731	8153.526	2.88%	1.94%	6.28%	1.78%
1973.25	25700.08	0.578	153.8994	8142.316	2.85%	1.46%	5.85%	1.90%
1973.333	25708	0.577	154.2167	8127.388	2.81%	0.94%	5.30%	1.76%
1973.416	25638.78	0.577	154.5243	8109.037	2.77%	0.42%	4.69%	1.61%
1973.5	25547.82	0.58	154.8216	8087.559	2.71%	-0.12%	4.14%	1.99%
1973.583	25505	0.579	155.1081	8063.25	2.65%	-0.66%	3.78%	1.85%
1973.666	25554.84	0.578	155.3829	8036.405	2.58%	-1.19%	3.66%	1.57%
1973.75	25640.54	0.579	155.6456	8007.32	2.51%	-1.71%	3.53%	1.81%
1973.833	25680	0.581	155.8954	7976.292	2.43%	-2.20%	3.06%	2.06%
1973.916	25617.58	0.582	156.1317	7943.615	2.35%	-2.68%	2.05%	1.90%
1974	25503.63	0.582	156.3539	7909.586	2.26%	-3.11%	0.82%	1.74%
1974.083	25415	0.582	156.5618	7874.59	2.17%	-3.51%	-0.24%	1.99%
1974.166	25404.75	0.582	156.7569	7839.364	2.07%	-3.85%	-0.83%	1.43%
1974.25	25430.73	0.582	156.9414	7804.734	1.98%	-4.15%	-1.05%	1.01%
1974.333	25427	0.58	157.1173	7771.527	1.88%	-4.38%	-1.09%	0.86%
1974.416	25347.58	0.58	157.2866	7740.569	1.79%	-4.54%	-1.14%	0.84%
1974 5	25226 31	0.58	157 4513	7712 687	1 70%	-4 64%	-1 26%	0.42%
1974 583	25117	0.58	157 6134	7688 707	1 62%	-4 65%	-1 52%	0.53%
1974 666	25056.9	0.578	157 775	7669 456	1.54%	-4 57%	-1.95%	0.38%
1974 75	25017 07	0.577	157 9381	7655 759	1.01%	-4.39%	-2 43%	0.00%
1974 833	24952	0.576	158 1047	7648 444	1 42%	-4 11%	-2.83%	-0.29%
1974 916	24832.89	0.573	158 2767	7648 337	1.37%	-3 72%	-3.06%	-0.82%
1975	24697.68	0.569	158 4562	7656 264	1.34%	-3 20%	-3 16%	-1 34%
1975 083	24601	0.564	158 6448	7672 716	1.33%	-2.56%	-3 20%	-1.99%
1975 166	24584 25	0.561	158 8423	7696 848	1.33%	-1 82%	-3 23%	-2.37%
1975 25	24635.86	0.56	159 0485	7727 477	1.34%	-0.99%	-3 13%	-2.50%
1975 333	24731	0 559	159 2628	7763 421	1.37%	-0.10%	-2 74%	-2.37%
1975 416	24846 18	0.56	159 4848	7803.5	1 40%	0.81%	-1.98%	-2 24%
1975 5	24963 16	0.558	159 714	7846 532	1 44%	1 74%	-1 04%	-2 49%
1975 583	25065	0.56	159 95	7891 335	1 48%	2 64%	-0.21%	-2 22%
1975 666	25143.2	0.561	160 1924	7936 728	1.40%	3 48%	0.34%	-1 82%
1975 75	25222 99	0.561	160.1024	7981 528	1.58%	4 26%	0.82%	-1 68%
1075 833	25338	0.561	160.4407	8024 555	1.60%	4.92%	1 55%	-1 54%
1975 916	25507.94	0.56	160.0540	8064 627	1.04%	4.02 <i>%</i>	2 72%	-1 28%
1976	25696 64	0.561	161 2169	8100 562	1 74%	5.80%	4 04%	-0.62%
1976 083	25854	0.564	161 4847	8131 472	1.74%	5.00%	5.09%	0.02%
1976.166	250/3 13	0.504	161 7568	8157 642	1.73%	5.00%	5.03%	0.40%
1970.100	25940.15	0.505	162 0335	8179 647	1.88%	5.85%	5.00%	1 / 1%
1076 333	2500.05	0.568	162 315	8108.066	1.00%	5.00%	5.40%	1.41%
1970.333	2000 36	0.500	162.010	8213 476	1.92 /0	5.00%	1.68%	1.03%
1970.410	26031.02	0.57	162.0014	8226 453	1.95%	1 84%	4.00%	1.00%
1076 583	20031.02	0.500	163 10	8237 576	2.03%	4.04%	4.20%	1.04 /0
1970.505	20039	0.57	163 /026	8247 421	2.05%	4.59%	3 78%	1.00%
1076 75	26135.52	0.57	163 2000	8256 566	2.00%	3.51/0	3.10%	1.72/0
1076 832	20100.40	0.509	16/ 1152	8265 589	2.09/0 2.120/	3.43 /0 3 000/2	3.02 /0	1.09/0
1076 016	20100	0.009	16/ /259	8275 064	2.13/0	0.00 /0 2 610/	2.00 /0 2 000/	1.00 /0
1077	20241.20	0.57	16/ 7626	8285 571	2.10/0 2.200/	2.01/0 2.20/	2.30 /0 2 /50/	1.00 /0
<i>ושו</i> נפח דקח	20020.12	0.07	165 006	0200.07 I 8207 524	2.2070 2.210/	2.20%	2.40% 2.20/	1.70%
1077 166	20429	0.07	165 4256	8210 767	2.24 /0 2 270/	2.04/0 1 Q00/	2.22 /0 7 200/	1.50 /0
1911.100	20001.00	0.372	100.4000	0010.707	2.2170	1.0070	2.30%	1.00%

1977.25	26716.45	0.574	165.781	8324.931	2.31%	1.78%	2.83%	1.50%
1977.333	26883	0.576	166.1321	8339.687	2.35%	1.73%	3.42%	1.64%
1977.416	27048.5	0.578	166.4883	8354.697	2.39%	1.72%	4.00%	1.65%
1977.5	27190	0.579	166.8494	8369.621	2.43%	1.74%	4.45%	2.06%
1977.583	27282	0.578	167.215	8384.122	2.47%	1.78%	4.69%	1.67%
1977.666	27306.45	0.58	167.5848	8397.859	2.50%	1.82%	4.65%	1.94%
1977 75	27275 07	0.581	167 9585	8410 494	2 54%	1.86%	4 36%	2 22%
1977 833	27207	0.582	168 3356	8421 69	2.57%	1 89%	3.90%	2.36%
1977 916	27131 16	0.586	168 7159	8431 105	2.60%	1.89%	3 37%	2.00%
1978	27115 57	0.587	169 0991	8438 403	2.63%	1.80%	3.00%	2.89%
1978 083	277238	0.588	169 4845	8443 296	2.00%	1.04%	3.06%	2.00%
1078 166	27530 72	0.500	160 8713	8445 704	2.00%	1.70%	3.68%	2 77%
1078 25	27015 85	0.500	170 258	8445 6	2.00%	1.0270	1 40%	2.77%
1079 222	21313.03	0.500	170.230	9442 056	2.70%	1.40%	4.00%	2.30%
1970.333	20220	0.592	170.0430	0442.950	2.12/0	0.00%	4.99%	2.70%
19/0.410	20303.03	0.593	171.0207	0437.744	2.73%	0.99%	4.07%	2.03%
1978.5	28397.19	0.595	171.4003	8429.937	2.73%	0.72%	4.44%	2.76%
1978.583	28418	0.593	171.7811	8419.507	2.73%	0.42%	4.10%	2.63%
1978.666	28501.57	0.594	172.1499	8406.426	2.72%	0.10%	4.38%	2.49%
1978.75	28618.8	0.595	1/2.5116	8390.667	2.71%	-0.24%	4.93%	2.48%
1978.833	28715	0.597	172.865	8372.202	2.69%	-0.59%	5.54%	2.61%
1978.916	28749.13	0.598	173.2089	8351.002	2.66%	-0.95%	5.96%	2.20%
1979	28734.73	0.598	173.5423	8327.042	2.63%	-1.32%	5.97%	2.06%
1979.083	28699	0.599	173.8642	8300.366	2.58%	-1.69%	5.36%	2.05%
1979.166	28666.28	0.601	174.1757	8271.319	2.53%	-2.06%	4.09%	2.29%
1979.25	28649.57	0.6	174.478	8240.317	2.48%	-2.43%	2.63%	2.15%
1979.333	28659	0.598	174.7723	8207.779	2.42%	-2.79%	1.54%	1.37%
1979.416	28698.51	0.598	175.0599	8174.121	2.36%	-3.12%	1.17%	1.22%
1979.5	28747.21	0.599	175.3422	8139.762	2.30%	-3.44%	1.23%	1.08%
1979.583	28778	0.6	175.6202	8105.119	2.23%	-3.73%	1.27%	1.44%
1979.666	28773.83	0.598	175.8953	8070.609	2.18%	-3.99%	0.96%	1.05%
1979.75	28757.78	0.6	176.1687	8036.65	2.12%	-4.22%	0.49%	1.16%
1979.833	28763	0.599	176.4416	8003.659	2.07%	-4.40%	0.17%	0.77%
1979.916	28805.48	0.6	176.7152	7972.054	2.02%	-4.54%	0.20%	0.76%
1980	28832.7	0.601	176.9908	7942.253	1.99%	-4.62%	0.34%	0.87%
1980.083	28775	0.6	177.2691	7914.54	1.96%	-4.65%	0.26%	0.61%
1980.166	28589.3	0.6	177.5492	7888.667	1.94%	-4.63%	-0.27%	0.36%
1980.25	28338.73	0.597	177.8296	7864.254	1.92%	-4.56%	-1.08%	0.11%
1980.333	28113	0.594	178.1091	7840.923	1.91%	-4.47%	-1.91%	-0.02%
1980.416	27983.49	0.591	178.3861	7818.291	1.90%	-4.35%	-2.49%	-0.40%
1980.5	27948.25	0.589	178.6594	7795.979	1.89%	-4.22%	-2.78%	-0.78%
1980.583	27987	0.588	178.9276	7773.607	1.88%	-4.09%	-2.75%	-1.03%
1980.666	28082.56	0.588	179,1893	7750.795	1.87%	-3.96%	-2.40%	-0.79%
1980.75	28230.13	0.589	179.4432	7727.162	1.86%	-3.85%	-1.83%	-0.91%
1980 833	28428	0.589	179 6879	7702 328	1 84%	-3 76%	-1 16%	-0 79%
1980 916	28661 52	0.59	179 922	7675 914	1 81%	-3 71%	-0.50%	-0.80%
1981	28864 3	0.59	180 1443	7647 538	1 78%	-3 71%	0.00%	-0.93%
1981 083	28957	0 591	180 3539	7616 962	1 74%	-3 76%	0.63%	-0.69%
1981 166	28893.61	0.507	180 5510	7584 51	1 69%	-3.86%	1.06%	-0 58%
1981 25	28761 42	0.00Z	180 7307	7550 646	1 64%	-3 00%	1 40%	0.00%
1981 333	28681	0.504	180 9189	7515 836	1 58%	-4 15%	2 02%	0.65%
1981 416	28734 00	0.500	181 0011	7480 544	1.50%	-4 32%	2.02 /0	0.00%
1021 5	2885/ 09	0.555	181 2577	7445 226	1 / 5%	-4 50%	2.00%	0.00%
1001.0	200000	0.09	101.2011	1770.200	1.70/0	- - 00/0	J.ZT /0	0.7370

1981.583	28931	0.591	181.4202	7410.376	1.39%	-4.67%	3.37%	0.73%
1981.666	28883.77	0.591	181.5802	7376.43	1.33%	-4.83%	2.85%	0.72%
1981.75	28731.61	0.587	181.7392	7343.862	1.28%	-4.96%	1.78%	0.07%
1981.833	28519	0.588	181.8987	7313.138	1.23%	-5.05%	0.32%	0.18%
1981.916	28291.14	0.586	182.0601	7284.722	1.19%	-5.10%	-1.29%	-0.21%
1982	28095.94	0.582	182.2249	7259.079	1.15%	-5.08%	-2.66%	-0.73%
1982.083	27982	0.582	182.3946	7236.594	1.13%	-4.99%	-3.37%	-0.86%
1982.166	27977.89	0.582	182.5701	7217.335	1.12%	-4.84%	-3.17%	-0.99%
1982.25	28032.08	0.581	182.7523	7201.286	1.11%	-4.63%	-2.54%	-1.36%
1982.333	28073	0.579	182.942	7188.435	1.12%	-4.36%	-2.12%	-1.86%
1982.416	28047.58	0.582	183.1401	7178.768	1.13%	-4.03%	-2.39%	-1.36%
1982.5	27976.77	0.578	183.3475	7172.272	1.15%	-3.67%	-3.04%	-1.24%
1982.583	27900	0.577	183.5651	7168.933	1.18%	-3.26%	-3.56%	-1.48%
1982.666	27850.45	0.578	183.7937	7168.737	1.22%	-2.82%	-3.58%	-1.34%
1982.75	27836.18	0.576	184.0342	7171.671	1.26%	-2.34%	-3.12%	-1.09%
1982.833	27859	0.574	184.2874	7177.722	1.31%	-1.85%	-2.31%	-1.46%
1982.916	27920.67	0.573	184.5541	7186.876	1.37%	-1.34%	-1.31%	-1.32%
1983	28022.81	0.572	184.8354	7199.119	1.43%	-0.83%	-0.26%	-0.93%
1983.083	28167	0.572	185,1315	7214.357	1.50%	-0.31%	0.66%	-0.91%
1983,166	28350.48	0.571	185.4418	7232.176	1.57%	0.21%	1.33%	-1.02%
1983.25	28553.01	0.571	185.765	7252.08	1.65%	0.71%	1.86%	-0.88%
1983 333	28750	0.573	186 0999	7273 574	1 73%	1 18%	2 41%	-0.35%
1983 416	28923.5	0.573	186 4454	7296 163	1.80%	1 64%	3 12%	-0 71%
1983 5	29082 1	0.578	186 8001	7319 35	1.88%	2 05%	3 95%	0.47%
1983 583	29241	0.581	187 1631	7342 642	1.96%	2 42%	4 81%	1 01%
1983 666	29411.8	0.582	187 5331	7365 542	2 03%	2 75%	5.61%	1 03%
1983.75	29591.63	0.584	187,9088	7387.555	2.11%	3.01%	6.31%	1.57%
1983 833	29774	0.584	188 2892	7408 186	2 17%	3 21%	6.87%	1 85%
1983 916	29953 74	0.587	188 6731	7426 939	2 23%	3 34%	7 28%	2 39%
1984	30130.93	0.588	189 0593	7443 32	2 29%	3 39%	7 52%	2 67%
1984 083	30307	0.588	189 4468	7456 938	2.33%	3.36%	7.60%	2 68%
1984 166	30480.93	0.591	189 8351	7467 823	2.37%	3 26%	7.51%	3 22%
1984 25	30641.98	0.591	190 224	7476 111	2.01 %	3.09%	7.32%	3 23%
1984 333	30777	0.593	190 6132	7481 939	2.10%	2.86%	7.02%	3 22%
1984 416	30876 93	0.597	191 0023	7485 442	2.40%	2.00%	6 75%	3 75%
1984 5	30949 12	0.599	191 3912	7486 755	2.44%	2.00%	6.42%	3 34%
1084 583	31005	0.000	101.0012	7486 015	2.40%	1 95%	6.03%	2.81%
1984 666	31055 53	0.596	192 167	7483 357	2.47%	1.60%	5 59%	2.01%
1984 75	31109.69	0.597	192 5534	7478 917	2.47%	1 24%	5 13%	2.42%
1084 833	31176	0.597	102.0004	7472 831	2.47%	0.87%	4 71%	2.20%
1084 016	31259.07	0.598	193 3216	7465 234	2.47%	0.52%	4 36%	2.20%
100-1.010	31348	0.500	193 7028	7456 263	2.40%	0.02%	4.00%	2.02%
1085 083	31/28	0.500	104 0810	7446 102	2.40%	_0 15%	3 70%	2.02%
1085 166	31/01 0/	0.555	104 4580	7435 134	2.45%	-0.15%	3 3 1 %	2.01%
1085 25	31556 13	0.0	104 8338	7403.104	2.44%	-0.77%	2 98%	2 00%
1085 333	31640	0.002	195 2068	7412 506	2.4270	-0.70%	2.30%	2.00%
1985 /16	31784 52	0.001	195.2000	7401 708	2.71/0	-0.33 %	2.00%	1 10%
1025 5	3103/ 05	0.001	105 0/77	7301 832	2.70/0 2 28%	-1.12/0	2.04/0	0 / 7%
1085 583	32052	0.590	106 3157	7383 302	2.30%	-1.27%	3 /10%	0.47 /0
1085 666	32120 21	0.099	106 6824	7376 560	2.31 /0	-1.37 /0	3.40% 3.46%	1 00%
1085 75	32129.01	0.0	107 0/77	7372 0/6	2.00%	-1.43%	3/11%	1 3/1%
1085 833	32770.00	0.003	107 /110	7370 172	2.00%	-1 37%	3 3/1%	1 33%
.000.000	02210	0.000	101.4110		2.02/0	1.07 /0	0.0470	1.0070

$\begin{array}{cccccccccccccccccccccccccccccccccccc$		20202 51	0.004						
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1986	3Z303.3T	0.604	198.1372	7376.096	2.29%	-1.08%	3.30%	1.20%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1986.083	32453	0.606	198.4986	7384.619	2.28%	-0.83%	3.26%	1.45%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1986.166	32484.29	0.603	198.859	7396.678	2.26%	-0.52%	3.15%	0.94%
1986.333325330.605199.57697429.7782.24%0.23%2.79%1.06%1986.41632605.840.605199.9347450.0042.23%0.65%2.58%1.06%1986.53327790.607200.28987472.1362.22%1.09%2.39%1.68%1986.563327790.608200.64427495.7692.20%1.52%2.25%1.68%1986.66632825.780.608201.34837545.9052.18%2.36%2.11%1.17%1986.7532849.610.608201.69777571.5932.17%2.73%2.02%1.29%1986.83328700.609202.04537597.1512.16%3.06%1.88%1.16%198732957.880.61202.39097622.1732.15%3.34%1.77%1.28%1987.083330360.61202.73457646.3182.13%3.54%1.80%1.03%1987.16633137.860.611203.75667713.0932.09%3.81%2.47%1.52%1987.41633397.410.616204.09377733.4672.08%3.80%2.43%1.88%1987.583335560.616204.78817771.392.06%3.68%2.37%1.50%1987.46633714.030.618205.77957821.2242.02%3.30%3.51%1.61%1987.573389.810.616205.77957821.2242.02%3.30%3.51%1.61%198	1986.25	32499.94	0.605	199.2185	7411.867	2.25%	-0.16%	2.99%	0.94%
1986.41632605.840.605199.9347450.0042.23%0.65%2.58%1.06%1986.5332698.170.607200.28987472.1362.22%1.09%2.39%1.68%1986.583327790.608200.64427495.7692.20%1.52%2.25%1.68%1986.66632825.780.608201.9977520.4942.19%1.95%2.17%1.55%1986.7532849.610.608201.34837545.9052.18%2.36%2.11%1.17%1986.833328700.609201.69777571.5932.17%2.73%2.02%1.29%1986.91632903.890.609202.04537597.1512.16%3.06%1.88%1.16%198732957.880.61202.39097622.1732.15%3.34%1.77%1.28%1987.083330360.61202.73457646.3182.13%3.54%1.80%1.03%1987.16633137.860.611203.07637669.522.12%3.69%2.01%1.53%1987.41633397.410.616204.03377733.4672.08%3.80%2.43%1.88%1987.5333457.910.614204.43117752.8992.07%3.76%2.37%1.50%1987.6633714.030.618205.77957821.2242.02%3.30%3.51%1.61%1987.83340250.618205.77957821.2242.02%3.30%3.51%1.61% <t< td=""><td>1986.333</td><td>32533</td><td>0.605</td><td>199.5769</td><td>7429.778</td><td>2.24%</td><td>0.23%</td><td>2.79%</td><td>1.06%</td></t<>	1986.333	32533	0.605	199.5769	7429.778	2.24%	0.23%	2.79%	1.06%
1986.532698.170.607200.2898 7472.136 2.22%1.09%2.39%1.68%1986.583327790.608200.6442 7495.769 2.20%1.52%2.25%1.68%1986.66632825.780.608200.997 7520.494 2.19%1.95%2.17%1.55%1986.7532849.610.608201.3483 7545.905 2.18%2.36%2.11%1.17%1986.833328700.609202.0453 7597.1593 2.17%2.73%2.02%1.29%1986.91632903.890.609202.0453 7597.151 2.16%3.06%1.88%1.16%198732957.880.61202.3099 7622.173 2.15%3.34%1.77%1.28%1987.083330360.61202.7345 7646.318 2.13%3.54%1.80%1.03%1987.16633137.860.611203.0763 7669.52 2.12%3.69%2.01%1.53%1987.2533245.370.612203.4166 7691.778 2.11%3.78%2.29%1.39%1987.53333560.613203.7556 7713.093 2.09%3.81%2.47%1.52%1987.41633397.410.616204.037 773.467 2.08%3.80%2.43%1.88%1987.5333457.910.614204.4311 7752.899 2.07%3.76%2.32%1.38%1987.6633714.030.618205.77957821.2242.02%3.30%3.51%	1986.416	32605.84	0.605	199.934	7450.004	2.23%	0.65%	2.58%	1.06%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1986.5	32698.17	0.607	200.2898	7472.136	2.22%	1.09%	2.39%	1.68%
1986.66632825.780.608200.9977520.4942.19%1.95%2.17%1.55%1986.7532849.610.608201.34837545.9052.18%2.36%2.11%1.17%1986.833328700.609201.69777571.5932.17%2.73%2.02%1.29%1986.91632903.890.609202.04537597.1512.16%3.06%1.88%1.16%198732957.880.61202.39097622.1732.15%3.34%1.77%1.28%1987.083330360.61202.73457646.3182.13%3.54%1.80%1.03%1987.16633137.860.611203.07637669.522.12%3.69%2.01%1.53%1987.2533245.370.612203.41667691.7782.11%3.78%2.29%1.39%1987.41633397.410.616204.09377733.4672.08%3.80%2.43%1.88%1987.5533457.910.614204.43117752.8992.07%3.76%2.32%1.38%1987.66633714.030.618205.77957821.2242.02%3.30%3.51%1.61%1987.83340250.618205.77957821.2242.02%3.30%3.51%1.61%1987.83340250.618205.77957821.2242.02%3.30%3.51%1.61%1987.83340250.616206.47697849.7542.01%2.99%3.47%1.73%	1986.583	32779	0.608	200.6442	7495,769	2.20%	1.52%	2.25%	1.68%
1986.75 32849.61 0.608 201.3483 7545.905 2.18% 2.36% 2.11% 1.17% 1986.833 32870 0.609 201.6977 7571.593 2.17% 2.73% 2.02% 1.29% 1986.916 32903.89 0.609 202.0453 7597.151 2.16% 3.06% 1.88% 1.16% 1987 32957.88 0.61 202.3909 7622.173 2.15% 3.34% 1.77% 1.28% 1987.083 33036 0.61 202.7345 7646.318 2.13% 3.54% 1.80% 1.03% 1987.166 33137.86 0.611 203.0763 7669.52 2.12% 3.69% 2.01% 1.53% 1987.25 33245.37 0.612 203.4166 7691.778 2.11% 3.78% 2.29% 1.39% 1987.416 33397.41 0.616 204.0937 7733.467 2.08% 3.80% 2.43% 1.88% 1987.583 33556 0.616 204.7681 7771.39 2.06% 3.68% 2.37% 1.50% 1987.666 33714.03 0.618<	1986.666	32825.78	0.608	200.997	7520.494	2.19%	1.95%	2.17%	1.55%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1986 75	32849 61	0.608	201 3483	7545 905	2 18%	2 36%	2 11%	1 17%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1986 833	32870	0.609	201 6977	7571 593	2 17%	2 73%	2 02%	1 29%
198732957.880.61202.39097622.1732.15%3.34%1.77%1.28%1987.083330360.61202.73457646.3182.13%3.54%1.80%1.03%1987.16633137.860.611203.07637669.522.12%3.69%2.01%1.53%1987.2533245.370.612203.41667691.7782.11%3.78%2.29%1.39%1987.33333360.613203.75567713.0932.09%3.81%2.47%1.52%1987.41633397.410.616204.09377733.4672.08%3.80%2.43%1.88%1987.5333457.910.614204.43117752.8992.07%3.76%2.32%1.38%1987.66633714.030.618205.10497788.9412.04%3.57%2.71%1.74%1987.7533889.810.616205.4427805.5522.03%3.44%3.17%1.50%1987.833340250.618205.77957821.2242.02%3.30%3.51%1.61%1987.91634081.420.619206.11777835.9582.02%3.14%3.58%1.74%1988.083341480.62206.79727862.5822.00%2.83%3.37%1.73%1988.26534409.340.619207.47947884.7062.00%2.67%3.40%1.73%1988.333345280.622207.82027893.6411.99%2.34%3.58%1.60%	1986 916	32903 89	0.609	202 0453	7597 151	2 16%	3.06%	1.88%	1 16%
1801182618211821182118211821182118211987.083330360.61202.73457646.3182.13% 3.54% 1.80% 1.03% 1987.16633137.860.611203.07637669.52 2.12% 3.69% 2.01% 1.53% 1987.2533245.370.612203.41667691.778 2.11% 3.78% 2.29% 1.39% 1987.33333360.613203.75567713.093 2.09% 3.81% 2.47% 1.52% 1987.41633397.410.616204.09377733.467 2.08% 3.80% 2.43% 1.88% 1987.53335560.616204.76817771.39 2.06% 3.68% 2.37% 1.50% 1987.66633714.030.618205.10497788.941 2.04% 3.57% 2.71% 1.74% 1987.7533889.810.616205.4427805.552 2.03% 3.44% 3.17% 1.50% 1987.833340250.618205.77957821.224 2.02% 3.30% 3.51% 1.61% 1987.91634081.420.619206.11777835.958 2.02% 3.14% 3.58% 1.74% 1988.083341480.62206.79727862.582 2.00% 2.83% 3.37% 1.73% 1988.16634263.280.621207.13827874.293 2.00% 2.67% 3.40% 1.73% 1988.333345280.622207.82027893.64	1987	32957.88	0.61	202 3909	7622 173	2.15%	3 34%	1.00%	1.10%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1987 083	33036	0.01	202.0000	7646 318	2.10%	3 54%	1.80%	1.20%
1987.16633245.370.612203.41667691.7782.11%3.78%2.29%1.39%1987.333333360.613203.75567713.0932.09%3.81%2.47%1.52%1987.41633397.410.616204.09377733.4672.08%3.80%2.43%1.88%1987.533457.910.614204.43117752.8992.07%3.76%2.32%1.38%1987.583335560.616204.76817771.392.06%3.68%2.37%1.50%1987.66633714.030.618205.10497788.9412.04%3.57%2.71%1.74%1987.7533889.810.616205.4427805.5522.03%3.44%3.17%1.50%1987.833340250.618205.77957821.2242.02%3.30%3.51%1.61%1987.91634081.420.619206.11777835.9582.02%3.14%3.58%1.74%1988.083341480.62206.79727862.5822.00%2.83%3.37%1.73%1988.16634263.280.621207.13827874.2932.00%2.67%3.40%1.73%1988.2534409.340.619207.47947884.7062.00%2.51%3.50%1.36%1988.333345280.622207.82027893.6411.99%2.34%3.58%1.60%1988.41634579.570.62208.167900.9181.99%2.17%3.54%0.99% <td>1987 166</td> <td>33137.86</td> <td>0.611</td> <td>202.1040</td> <td>7669 52</td> <td>2.10%</td> <td>3.69%</td> <td>2 01%</td> <td>1.53%</td>	1987 166	33137.86	0.611	202.1040	7669 52	2.10%	3.69%	2 01%	1.53%
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1087 25	33245 37	0.612	203.0700	7601 778	2.12%	3 78%	2.01%	1 30%
1987.436 33397.41 0.616 204.0937 7733.467 2.08% 3.80% 2.43% 1.88% 1987.5 33457.91 0.614 204.4311 7752.899 2.07% 3.76% 2.32% 1.38% 1987.583 33556 0.616 204.7681 7771.39 2.06% 3.68% 2.37% 1.50% 1987.666 33714.03 0.618 205.1049 7788.941 2.04% 3.57% 2.71% 1.74% 1987.75 33889.81 0.616 205.442 7805.552 2.03% 3.44% 3.17% 1.50% 1987.833 34025 0.618 205.7795 7821.224 2.02% 3.30% 3.51% 1.61% 1987.916 34081.42 0.619 206.1177 7835.958 2.02% 3.14% 3.58% 1.74% 1988.083 34101.55 0.62 206.4569 7849.754 2.01% 2.99% 3.47% 1.73% 1988.166 34263.28 0.621 207.1382 7874.293 2.00% 2.67% 3.40% 1.73% 1988.25 34409.34	1087 333	33336	0.612	203.7556	7713 003	2.11%	3 81%	2.23%	1.53%
1987.410 33337.41 0.010 204.0337 7733.407 2.00% 3.00% 2.43% 1.88% 1987.5 33457.91 0.614 204.4311 7752.899 2.07% 3.76% 2.32% 1.38% 1987.583 33556 0.616 204.7681 7771.39 2.06% 3.68% 2.37% 1.50% 1987.666 33714.03 0.618 205.1049 7788.941 2.04% 3.57% 2.71% 1.74% 1987.75 33889.81 0.616 205.442 7805.552 2.03% 3.44% 3.17% 1.50% 1987.833 34025 0.618 205.7795 7821.224 2.02% 3.30% 3.51% 1.61% 1987.916 34081.42 0.619 206.1177 7835.958 2.02% 3.14% 3.58% 1.74% 1988 34101.55 0.62 206.4569 7849.754 2.01% 2.99% 3.47% 1.73% 1988.083 34148 0.62 206.7972 7862.582 2.00% 2.67% 3.40% 1.73% 1988.166 34263.28 0.621 </td <td>1987.416</td> <td>33307 /1</td> <td>0.015</td> <td>203.7550</td> <td>7733 467</td> <td>2.09%</td> <td>3.01%</td> <td>2.47 /0</td> <td>1.92 /0</td>	1987.416	33307 /1	0.015	203.7550	7733 467	2.09%	3.01%	2.47 /0	1.92 /0
1987.5 33437.91 0.014 204.4311 7732.899 2.07% 3.70% 2.32% 1.38% 1987.583 33556 0.616 204.7681 7771.39 2.06% 3.68% 2.37% 1.50% 1987.666 33714.03 0.618 205.1049 7788.941 2.04% 3.57% 2.71% 1.74% 1987.65 33889.81 0.616 205.442 7805.552 2.03% 3.44% 3.17% 1.50% 1987.833 34025 0.618 205.7795 7821.224 2.02% 3.30% 3.51% 1.61% 1987.916 34081.42 0.619 206.1177 7835.958 2.02% 3.14% 3.58% 1.74% 1988 34101.55 0.62 206.4569 7849.754 2.01% 2.99% 3.47% 1.73% 1988.083 34148 0.62 206.7972 7862.582 2.00% 2.83% 3.37% 1.73% 1988.166 34263.28 0.621 207.1382 7874.293 2.00% 2.67% 3.40% 1.73% 1988.333 34528 0.622	1097.5	33397.41	0.010	204.0937	7752 200	2.00%	3.00%	2.43 /0	1.00/0
1987.365 33536 0.016 204.7681 7771.39 2.00% 3.08% 2.37% 1.50% 1987.666 33714.03 0.618 205.1049 7788.941 2.04% 3.57% 2.71% 1.74% 1987.75 33889.81 0.616 205.442 7805.552 2.03% 3.44% 3.17% 1.50% 1987.833 34025 0.618 205.7795 7821.224 2.02% 3.30% 3.51% 1.61% 1987.916 34081.42 0.619 206.1177 7835.958 2.02% 3.14% 3.58% 1.74% 1988 34101.55 0.62 206.4569 7849.754 2.01% 2.99% 3.47% 1.73% 1988.083 34148 0.62 206.7972 7862.582 2.00% 2.83% 3.37% 1.73% 1988.166 34263.28 0.621 207.1382 7874.293 2.00% 2.67% 3.40% 1.73% 1988.25 34409.34 0.619 207.4794 7884.706 2.00% 2.51% 3.50% 1.36% 1988.333 34528 0.622 <td>1907.0</td> <td>22556</td> <td>0.014</td> <td>204.4311</td> <td>7771 20</td> <td>2.07 /0</td> <td>3.70%</td> <td>2.32 /0</td> <td>1.50 /0</td>	1907.0	22556	0.014	204.4311	7771 20	2.07 /0	3.70%	2.32 /0	1.50 /0
1987.066 33714.03 0.616 205.1049 7786.941 2.04% 3.57% 2.71% 1.74% 1987.75 33889.81 0.616 205.442 7805.552 2.03% 3.44% 3.17% 1.50% 1987.833 34025 0.618 205.7795 7821.224 2.02% 3.30% 3.51% 1.61% 1987.916 34081.42 0.619 206.1177 7835.958 2.02% 3.14% 3.58% 1.74% 1988 34101.55 0.62 206.4569 7849.754 2.01% 2.99% 3.47% 1.73% 1988.083 34148 0.62 206.7972 7862.582 2.00% 2.83% 3.37% 1.73% 1988.166 34263.28 0.621 207.1382 7874.293 2.00% 2.67% 3.40% 1.73% 1988.25 34409.34 0.619 207.4794 7884.706 2.00% 2.51% 3.50% 1.36% 1988.333 34528 0.622 207.8202 7893.641 1.99% 2.34% 3.58% 1.60% 1988.416 34579.57 0.62<	1907.000	22714 02	0.010	204.7001	7700 044	2.00%	3.00%	2.37 %	1.30%
1987.75 33889.81 0.616 205.442 7805.552 2.03% 3.44% 3.17% 1.50% 1987.833 34025 0.618 205.7795 7821.224 2.02% 3.30% 3.51% 1.61% 1987.916 34081.42 0.619 206.1177 7835.958 2.02% 3.14% 3.58% 1.74% 1988 34101.55 0.62 206.4569 7849.754 2.01% 2.99% 3.47% 1.73% 1988.083 34148 0.62 206.7972 7862.582 2.00% 2.83% 3.37% 1.73% 1988.166 34263.28 0.621 207.1382 7874.293 2.00% 2.67% 3.40% 1.73% 1988.25 34409.34 0.619 207.4794 7884.706 2.00% 2.51% 3.50% 1.36% 1988.333 34528 0.622 207.8202 7893.641 1.99% 2.34% 3.58% 1.60% 1988.416 34579.57 0.62 208.16 7900.918 1.99% 2.17% 3.54% 0.99%	1907.000	337 14.03	0.010	205.1049	7005 550	2.04%	3.57%	2.71%	1.74%
1987.833 34025 0.618 205.7795 7821.224 2.02% 3.30% 3.51% 1.61% 1987.916 34081.42 0.619 206.1177 7835.958 2.02% 3.14% 3.58% 1.74% 1988 34101.55 0.62 206.4569 7849.754 2.01% 2.99% 3.47% 1.73% 1988.083 34148 0.62 206.7972 7862.582 2.00% 2.83% 3.37% 1.73% 1988.166 34263.28 0.621 207.1382 7874.293 2.00% 2.67% 3.40% 1.73% 1988.25 34409.34 0.619 207.4794 7884.706 2.00% 2.51% 3.50% 1.36% 1988.333 34528 0.622 207.8202 7893.641 1.99% 2.34% 3.58% 1.60% 1988.416 34579.57 0.62 208.16 7900.918 1.99% 2.17% 3.54% 0.99%	1987.75	33889.81	0.616	205.442	7805.552	2.03%	3.44%	3.17%	1.50%
1987.916 34081.42 0.619 206.1177 7835.958 2.02% 3.14% 3.58% 1.74% 1988 34101.55 0.62 206.4569 7849.754 2.01% 2.99% 3.47% 1.73% 1988.083 34148 0.62 206.7972 7862.582 2.00% 2.83% 3.37% 1.73% 1988.166 34263.28 0.621 207.1382 7874.293 2.00% 2.67% 3.40% 1.73% 1988.25 34409.34 0.619 207.4794 7884.706 2.00% 2.51% 3.50% 1.36% 1988.333 34528 0.622 207.8202 7893.641 1.99% 2.34% 3.58% 1.60% 1988.416 34579.57 0.62 208.16 7900.918 1.99% 2.17% 3.54% 0.99%	1987.833	34025	0.618	205.7795	7821.224	2.02%	3.30%	3.51%	
198834101.550.62206.45697849.7542.01%2.99%3.47%1.73%1988.083341480.62206.79727862.5822.00%2.83%3.37%1.73%1988.16634263.280.621207.13827874.2932.00%2.67%3.40%1.73%1988.2534409.340.619207.47947884.7062.00%2.51%3.50%1.36%1988.333345280.622207.82027893.6411.99%2.34%3.58%1.60%1988.41634579.570.62208.167900.9181.99%2.17%3.54%0.99%	1987.916	34081.42	0.619	206.1177	7835.958	2.02%	3.14%	3.58%	1.74%
1988.083341480.62206.79727862.5822.00%2.83%3.37%1.73%1988.16634263.280.621207.13827874.2932.00%2.67%3.40%1.73%1988.2534409.340.619207.47947884.7062.00%2.51%3.50%1.36%1988.333345280.622207.82027893.6411.99%2.34%3.58%1.60%1988.41634579.570.62208.167900.9181.99%2.17%3.54%0.99%	1988	34101.55	0.62	206.4569	7849.754	2.01%	2.99%	3.47%	1.73%
1988.166 34263.28 0.621 207.1382 7874.293 2.00% 2.67% 3.40% 1.73% 1988.25 34409.34 0.619 207.4794 7884.706 2.00% 2.51% 3.50% 1.36% 1988.333 34528 0.622 207.8202 7893.641 1.99% 2.34% 3.58% 1.60% 1988.416 34579.57 0.62 208.16 7900.918 1.99% 2.17% 3.54% 0.99%	1988.083	34148	0.62	206.7972	7862.582	2.00%	2.83%	3.37%	1.73%
1988.25 34409.34 0.619 207.4794 7884.706 2.00% 2.51% 3.50% 1.36% 1988.333 34528 0.622 207.8202 7893.641 1.99% 2.34% 3.58% 1.60% 1988.416 34579.57 0.62 208.16 7900.918 1.99% 2.17% 3.54% 0.99%	1988.166	34263.28	0.621	207.1382	7874.293	2.00%	2.67%	3.40%	1.73%
1988.333 34528 0.622 207.8202 7893.641 1.99% 2.34% 3.58% 1.60% 1988.416 34579.57 0.62 208.16 7900.918 1.99% 2.17% 3.54% 0.99%	1988.25	34409.34	0.619	207.4794	7884.706	2.00%	2.51%	3.50%	1.36%
1988.416 34579.57 0.62 208.16 7900.918 1.99% 2.17% 3.54% 0.99%	1988.333	34528	0.622	207.8202	7893.641	1.99%	2.34%	3.58%	1.60%
	1988.416	34579.57	0.62	208.16	7900.918	1.99%	2.17%	3.54%	0.99%
1988.5 34598.32 0.623 208.4983 7906.357 1.99% 1.98% 3.41% 1.60%	1988.5	34598.32	0.623	208.4983	7906.357	1.99%	1.98%	3.41%	1.60%
1988.583 34637 0.623 208.8345 7909.776 1.99% 1.78% 3.22% 1.35%	1988.583	34637	0.623	208.8345	7909.776	1.99%	1.78%	3.22%	1.35%
1988.666 34733.83 0.624 209.1681 7910.997 1.98% 1.57% 3.02% 1.22%	1988.666	34733.83	0.624	209.1681	7910.997	1.98%	1.57%	3.02%	1.22%
1988.75 34868.96 0.624 209.4984 7909.839 1.97% 1.34% 2.89% 1.47%	1988.75	34868.96	0.624	209.4984	7909.839	1.97%	1.34%	2.89%	1.47%
1988.833 35008 0.625 209.825 7906.121 1.97% 1.09% 2.89% 1.34%	1988.833	35008	0.625	209.825	7906.121	1.97%	1.09%	2.89%	1.34%
1988.916 35123.47 0.627 210.1472 7899.664 1.95% 0.81% 3.06% 1.46%	1988.916	35123.47	0.627	210.1472	7899.664	1.95%	0.81%	3.06%	1.46%
1989 35215.48 0.626 210.4646 7890.287 1.94% 0.52% 3.27% 1.21%	1989	35215.48	0.626	210.4646	7890.287	1.94%	0.52%	3.27%	1.21%
1989.083 35291 0.629 210.7764 7877.919 1.92% 0.20% 3.35% 1.57%	1989.083	35291	0.629	210.7764	7877.919	1.92%	0.20%	3.35%	1.57%
1989.166 35357.01 0.629 211.0818 7862.92 1.90% -0.14% 3.19% 1.44%	1989.166	35357.01	0.629	211.0818	7862.92	1.90%	-0.14%	3.19%	1.44%
1989.25 35420.39 0.629 211.3798 7845.763 1.88% -0.49% 2.94% 1.68%	1989.25	35420.39	0.629	211.3798	7845.763	1.88%	-0.49%	2.94%	1.68%
1989.333 35488 0.629 211.6695 7826.916 1.85% -0.85% 2.78% 1.31%	1989.333	35488	0.629	211.6695	7826.916	1.85%	-0.85%	2.78%	1.31%
1989.416 35561.85 0.629 211.9499 7806.85 1.82% -1.19% 2.84% 1.54%	1989.416	35561.85	0.629	211.9499	7806.85	1.82%	-1.19%	2.84%	1.54%
1989.5 35624.59 0.63 212.2201 7786.037 1.79% -1.52% 2.97% 1.29%	1989.5	35624.59	0.63	212.2201	7786.037	1.79%	-1.52%	2.97%	1.29%
1989.583 35654 0.63 212.4791 7764.944 1.75% -1.83% 2.94% 1.28%	1989.583	35654	0.63	212.4791	7764.944	1.75%	-1.83%	2.94%	1.28%
1989.666 35639.47 0.631 212.7259 7744.045 1.70% -2.11% 2.61% 1.27%	1989.666	35639.47	0.631	212.7259	7744.045	1.70%	-2.11%	2.61%	1.27%
1989.75 35616.71 0.628 212.9598 7723.807 1.65% -2.35% 2.14% 0.89%	1989.75	35616.71	0.628	212.9598	7723.807	1.65%	-2.35%	2.14%	0.89%
1989.833 35633 0.629 213.1796 7704.703 1.60% -2.55% 1.79% 0.88%	1989.833	35633	0.629	213.1796	7704.703	1.60%	-2.55%	1.79%	0.88%
1989.916 35719.04 0.63 213.3845 7687.201 1.54% -2.69% 1.70% 0.74%	1989.916	35719.04	0.63	213.3845	7687.201	1.54%	-2.69%	1.70%	0.74%
1990 35839.14 0.63 213.5735 7671.773 1.48% -2.77% 1.77% 0.85%	1990	35839.14	0.63	213.5735	7671.773	1.48%	-2.77%	1.77%	0.85%
1990.083 35941 0.632 213.7463 7658.78 1.41% -2.78% 1.84% 0.71%	1990.083	35941	0.632	213.7463	7658.78	1.41%	-2.78%	1.84%	0.71%
1990.166 35985.44 0.632 213.9042 7648.148 1.34% -2.73% 1.78% 0.69%	1990.166	35985.44	0.632	213.9042	7648.148	1.34%	-2.73%	1.78%	0.69%

1990.25	35985.67	0.632	214.0489	7639.694	1.26%	-2.63%	1.60%	0.67%
1990.333	35968	0.63	214.1824	7633.235	1.19%	-2.47%	1.35%	0.42%
1990.416	35950.57	0.631	214.3063	7628.589	1.11%	-2.28%	1.09%	0.52%
1990.5	35918.81	0.629	214.4226	7625.573	1.04%	-2.06%	0.83%	0.14%
1990.583	35850	0.628	214.5331	7624.004	0.97%	-1.82%	0.55%	0.00%
1990.666	35729.73	0.627	214.6394	7623.699	0.90%	-1.55%	0.25%	-0.25%
1990.75	35576.97	0.625	214,7435	7624.476	0.84%	-1.29%	-0.11%	-0.15%
1990 833	35419	0.625	214 847	7626 152	0.78%	-1 02%	-0.60%	-0.28%
1990 916	35281 57	0.623	214 9517	7628 543	0.73%	-0.76%	-1 22%	-0.65%
1991	35184 24	0.622	215 0594	7631 468	0.70%	-0.53%	-1 83%	-0.78%
1991 083	35145	0.62	215 1716	7634 763	0.67%	-0.31%	-2 21%	-1 26%
1991 166	35172 57	0.619	215 2882	7638 351	0.65%	-0.13%	-2.26%	-1.38%
1991 25	35238 49	0.618	215 4092	7642 172	0.64%	0.03%	-2.08%	-1 50%
1001.20	35305	0.010	215 5341	7646 168	0.63%	0.00%	-1 84%	-1 03%
1001.000	35342 4	0.02	215.6620	7650 270	0.00%	0.77%	1 60%	1 62%
1001 5	35352.9	0.010	215.0029	7654 440	0.03%	0.20%	-1.0970	-1.02/0
1001 502	25240	0.017	215.7952	7659 619	0.04 %	0.36%	-1.57 /0	-1.27/0
1991.565	35340	0.010	215.9309	7000.010	0.05%	0.45%	-1.40%	-1.27%
1991.000	35330.01	0.015	216.0097	7002.727	0.07%	0.51%	-1.09%	-1.27%
1991.75	35343.4	0.616	216.2114	7666.719	0.68%	0.55%	-0.66%	-0.91%
1991.833	35381	0.615	216.3557	7670.534	0.70%	0.58%	-0.11%	-1.02%
1991.916	35463.79	0.614	216.5024	7674.115	0.72%	0.60%	0.52%	-0.90%
1992	35575.8	0.612	216.6513	/6//.401	0.74%	0.60%	1.11%	-1.02%
1992.083	35694	0.615	216.8023	7680.358	0.76%	0.60%	1.56%	-0.42%
1992.166	35799.55	0.613	216.9557	7683.031	0.77%	0.58%	1.78%	-0.53%
1992.25	35890.24	0.615	217.1117	7685.492	0.79%	0.57%	1.85%	-0.17%
1992.333	35968	0.616	217.2707	7687.808	0.81%	0.54%	1.88%	-0.28%
1992.416	36036.3	0.615	217.4331	7690.051	0.82%	0.52%	1.96%	0.08%
1992.5	36104.63	0.615	217.5993	7692.288	0.84%	0.49%	2.13%	-0.03%
1992.583	36184	0.616	217.7695	7694.59	0.85%	0.47%	2.37%	0.21%
1992.666	36278.8	0.616	217.9442	7697.026	0.87%	0.45%	2.66%	0.34%
1992.75	36367	0.614	218.1236	7699.665	0.88%	0.43%	2.90%	-0.02%
1992.833	36420	0.613	218.3082	7702.577	0.90%	0.42%	2.94%	-0.02%
1992.916	36420.25	0.614	218.4981	7705.831	0.92%	0.41%	2.70%	0.23%
1993	36394.61	0.614	218.6939	7709.497	0.94%	0.42%	2.30%	0.48%
1993.083	36381	0.614	218.8957	7713.613	0.97%	0.43%	1.92%	0.12%
1993.166	36406.04	0.614	219.1031	7718.095	0.99%	0.46%	1.69%	0.37%
1993.25	36451.04	0.615	219.3157	7722.829	1.02%	0.49%	1.56%	0.25%
1993.333	36486	0.615	219.533	7727.699	1.04%	0.52%	1.44%	0.14%
1993.416	36492.34	0.617	219.7545	7732.592	1.07%	0.55%	1.27%	0.51%
1993.5	36497.16	0.618	219.9798	7737.393	1.09%	0.59%	1.09%	0.64%
1993.583	36539	0.618	220.2082	7741.986	1.12%	0.62%	0.98%	0.52%
1993.666	36642.95	0.62	220.4395	7746.257	1.14%	0.64%	1.00%	0.77%
1993.75	36780.33	0.617	220.6731	7750.092	1.17%	0.65%	1.14%	0.66%
1993.833	36909	0.618	220.9085	7753.376	1.19%	0.66%	1.34%	0.91%
1993.916	36999.77	0.619	221.1452	7755.994	1.21%	0.65%	1.59%	0.91%
1994	37075.26	0.62	221.3829	7757.831	1.23%	0.63%	1.87%	1.04%
1994.083	37171	0.622	221.6212	7758.823	1.25%	0.59%	2.17%	1.29%
1994.166	37308.99	0.623	221.8604	7759.105	1.26%	0.53%	2.48%	1.41%
1994.25	37456.94	0.621	222.1011	7758.863	1.27%	0.47%	2.76%	1.05%
1994.333	37569	0.623	222.3438	7758.284	1.28%	0.40%	2.97%	1.30%
1994.416	37615.53	0.625	222.589	7757.551	1.29%	0.32%	3.08%	1.29%
1994.5	37631.73	0.623	222.8372	7756.852	1.30%	0.25%	3.11%	0.93%

1994.583	37669	0.623	223.0891	7756.372	1.31%	0.19%	3.09%	0.93%
1994.666	37762.41	0.626	223.345	7756.297	1.32%	0.13%	3.06%	1.06%
1994.75	37881.63	0.627	223.6055	7756.811	1.33%	0.09%	2.99%	1.55%
1994.833	37980	0.629	223.8711	7758.102	1.34%	0.06%	2.90%	1.67%
1994.916	38022.88	0.63	224.1423	7760.355	1.36%	0.06%	2.77%	1.67%
1995	38023.72	0.631	224.4197	7763.755	1.37%	0.08%	2.56%	1.67%
1995.083	38008	0.63	224,7035	7768.421	1.39%	0.12%	2.25%	1.31%
1995 166	37998 12	0.631	224 9935	7774 198	1 41%	0.19%	1 85%	1 32%
1995 25	38004 14	0.631	225 2891	7780 866	1 44%	0.28%	1 46%	1.57%
1995 333	38033	0.631	225 5899	7788 204	1 46%	0.39%	1 24%	1 33%
1995 416	38088 29	0.627	225 8955	7795.99	1 49%	0.50%	1 26%	0.61%
1995 5	38160.07	0.627	226 2052	7804 004	1.10%	0.61%	1 40%	0.86%
1995 583	38235	0.628	226 5187	7812 023	1 54%	0.72%	1.10%	0.00%
1995 666	38301 38	0.628	226.8354	7819 827	1.54%	0.82%	1.00%	0.00%
1005 75	38353.03	0.620	220.0004	7827 105	1.50%	0.02 /0	1.45%	0.60%
1005 022	20222.92	0.029	227.1343	7027.195	1.59%	0.91/0	1.2370	0.04 /0
1995.055	20110 02	0.029	227.4707	7033.905	1.01/0	0.90%	1.00%	0.40%
1995.910	30410.02	0.626	227.0003	7039.737	1.03%	1.02%	1.02%	0.17%
1990	38448.74	0.627	228.1253	7844.408		1.04%	1.12%	-0.06%
1996.083	38544	0.627	228.4512	/84/.933	1.67%	1.02%	1.41%	0.06%
1996.166	38/1/.91	0.629	228.7787	7850.18	1.68%	0.98%	1.89%	0.18%
1996.25	38925.73	0.63	229.1081	7851.314	1.70%	0.91%	2.42%	0.30%
1996.333	39106	0.63	229.4401	7851.439	1.71%	0.81%	2.82%	0.31%
1996.416	39214.78	0.63	229.7752	7850.659	1.72%	0.70%	2.96%	0.79%
1996.5	39278.22	0.632	230.1141	7849.077	1.73%	0.58%	2.93%	1.03%
1996.583	39340	0.633	230.4573	7846.798	1.74%	0.45%	2.89%	1.03%
1996.666	39431.83	0.633	230.8053	7843.925	1.75%	0.31%	2.95%	1.03%
1996.75	39537.53	0.634	231.1588	7840.564	1.76%	0.17%	3.09%	1.04%
1996.833	39629	0.635	231.5183	7836.816	1.78%	0.04%	3.23%	1.16%
1996.916	39688.77	0.634	231.8844	7832.787	1.79%	-0.09%	3.33%	1.16%
1997	39742.12	0.634	232.2576	7828.581	1.81%	-0.20%	3.36%	1.29%
1997.083	39825	0.634	232.6384	7824.302	1.83%	-0.30%	3.32%	1.30%
1997.166	39962.27	0.634	233.0266	7820.059	1.86%	-0.38%	3.21%	1.06%
1997.25	40134.46	0.636	233.4217	7815.962	1.88%	-0.45%	3.11%	1.18%
1997.333	40311	0.637	233.8236	7812.119	1.91%	-0.50%	3.08%	1.31%
1997.416	40466.06	0.638	234.2318	7808.641	1.94%	-0.54%	3.19%	1.44%
1997.5	40592.78	0.637	234.6459	7805.637	1.97%	-0.55%	3.35%	1.09%
1997.583	40689	0.639	235.0657	7803.216	2.00%	-0.56%	3.43%	1.21%
1997.666	40756.43	0.639	235.4908	7801.489	2.03%	-0.54%	3.36%	1.22%
1997.75	40812.13	0.639	235.9209	7800.563	2.06%	-0.51%	3.22%	1.11%
1997 833	40877	0.639	236 3556	7800 55	2.09%	-0.46%	3 15%	0.99%
1997 916	40966 02	0.641	236 7946	7801 558	2.00%	-0.40%	3 22%	1.36%
1007.010	40000.02	0.64	237 2375	7803 698	2.12%	-0.40%	3 34%	1.00%
1008 083	41176	0.04	237 68/1	7807.057	2.17%	0.02%	3 30%	1.25%
1008 166	41271.85	0.04	238 1342	7811 648	2.17%	-0.2270	3 28%	1.25%
1990.100	41271.00	0.04	230.1342	7011.040	2.19/0	-0.11%	3.20 /0	1.20%
1990.20	41303.05	0.04	230.3070	7017.401	2.2170	0.02%	2 95%	1.02%
1990.333	41401	0.041	239.045	7024.407	2.23%	0.10%	2.03%	1.03%
1990.410	41373.14	0.041	239.0005	7032.713	2.23%	0.31%	2.74/0	0.92/0
1000 500	41/07.90 07014	0.04	209.9090	1042.130	2.2170 2.200/	U.4/%	2.1070	0.92%
1990.003	410/3	0.64	240.4300	1002.145	2.28%	U.03%	2.91%	0.09%
1998.666	42008.07	0.639	240.9075	1004.521	2.30%	0.81%	3.22%	0.58%
1998.75	42266.79	0.642	241.3814	/8//.4/6	2.31%	0.99%	3.56%	0.93%
1998.833	42432	0.641	241.8586	7891.581	2.33%	1.17%	3.80%	0.82%

1998.916	42539.57	0.642	242.339	7906.833	2.34%	1.35%	3.84%	0.70%
1999	42607.15	0.643	242.8225	7923.224	2.35%	1.53%	3.74%	0.94%
1999.083	42663	0.644	243.309	7940.657	2.37%	1.71%	3.61%	1.06%
1999.166	42729.97	0.642	243.7979	7958.695	2.38%	1.88%	3.53%	0.83%
1999.25	42809.34	0.642	244.2885	7976.811	2.39%	2.04%	3.50%	0.83%
1999.333	42897	0.642	244.7799	7994.483	2.40%	2.17%	3.46%	0.72%
1999.416	42993.67	0.643	245.2715	8011.185	2.41%	2.28%	3.42%	0.84%
1999.5	43119.39	0.642	245.7625	8026.391	2.41%	2.35%	3.38%	0.84%
1999.583	43299	0.642	246.2522	8039.579	2.42%	2.38%	3.41%	0.84%
1999.666	43539.2	0.642	246.7399	8050.223	2.42%	2.36%	3.50%	0.96%
1999.75	43773.93	0.642	247.2249	8057.798	2.42%	2.29%	3.57%	0.61%
1999.833	43919	0.643	247.7065	8061.779	2.42%	2.16%	3.50%	0.84%
1999.916	43925.77	0.644	248.1839	8061.643	2.41%	1.96%	3.26%	0.84%
2000	43887.99	0.644	248.6564	8056.864	2.40%	1.69%	3.01%	0.72%
2000.083	43935	0.646	249.1235	8047.138	2.39%	1.34%	2.98%	0.83%
2000.166	44150.81	0.646	249.5848	8033.045	2.37%	0.93%	3.33%	1.06%
2000.25	44438.04	0.646	250.0399	8015.384	2.35%	0.48%	3.80%	1.06%
2000.333	44654	0.647	250.4887	7994.956	2.33%	0.01%	4.10%	1.17%
2000.416	44698.15	0.644	250.9308	7972.56	2.31%	-0.48%	3.96%	0.69%
2000 5	44638 7	0.645	251 3661	7948 997	2 28%	-0.96%	3 52%	0.92%
2000 583	44586	0.642	251 7941	7925 065	2 25%	-1 42%	2.97%	0.56%
2000 666	44618 91	0.642	252 2146	7901 565	2 22%	-1 85%	2 48%	0.55%
2000 75	44690 17	0.642	252 6273	7879 298	2 19%	-2 22%	2.09%	0.55%
2000 833	44721	0.642	253 032	7859 062	2 15%	-2.51%	1.83%	0.42%
2000.000	44658 87	0.643	253 4284	7841 658	2.10%	-2 73%	1.00%	0.42%
2001	44556 29	0.644	253 8161	7827 886	2.08%	-2 84%	1.52%	0.52%
2001 083	44492	0.644	254 1953	7818 318	2.00%	-2.84%	1 27%	0.28%
2001 166	44519.08	0.643	254 5668	7812 614	2.01%	-2 74%	0.83%	0.15%
2001 25	44587 87	0.643	254 932	7810 208	1.96%	-2.56%	0.34%	0.10%
2001 333	44623	0.64	255 2922	7810 531	1 92%	-2.31%	-0.07%	-0.33%
2001 416	44571 09	0.638	255 6488	7813 018	1.88%	-2.01%	-0.28%	-0.23%
2001.5	44466 6	0.637	256 003	7817 1	1.86%	-1 66%	-0.39%	-0.47%
2001 583	44366	0.637	256 3561	7822 211	1.81%	-1.30%	-0.49%	-0.13%
2001.666	44315 5	0.632	256 7093	7827 784	1 78%	-0.93%	-0.68%	-0.72%
2001.000	44320 46	0.635	257 0641	7833 251	1.76%	-0.58%	-0.83%	-0.38%
2001.70	44376	0.632	257 4216	7838 044	1.73%	-0.27%	-0.77%	-0.73%
2001.000	44473 17	0.002	257 7832	7841 598	1.73%	0.27%	-0.42%	-1.09%
2001.010	44586.65	0.00	258 1501	7843 345	1.72%	0.00%	0.42%	-1 32%
2002 083	4400.00	0.627	258 5234	7842 878	1.71%	0.20%	0.07%	-1.52%
2002.005	44007 11752 01	0.027	258 0028	7840 432	1.70%	0.31%	0.44%	-1.00%
2002.100	44795 51	0.00	250.3020	7836 403	1.70%	0.30%	0.33%	-1.03%
2002.20	1/83/	0.020	250 6786	7831 187	1.71%	0.04%	0.47%	1.02%
2002.333	11880 00	0.027	260 0741	7825 181	1.72%	0.2070	0.47%	-1.03%
2002.410	44000.99	0.023	260.0741	7818 770	1.75%	0.10%	1 03%	0.03%
2002.3	44922.31	0.027	260 8782	7812 378	1.75%	0.02%	1.03%	-0.74%
2002.505	44950	0.027	200.0702	7806 373	1.70%	0.13%	1.2970	-0.74%
2002.000	44915.55	0.027	201.200	7801 161	1.70%	-0.27 /0	1.35%	-0.1370
2002.10	1/257	0.03	262 11087	7707 126	1.00 /0	-0.41/0 _0.52%	1.20/0 1 NR%	-0.14/0 _0 1/0/
2002.000	1/1007 1/1076 15	0.027	262 5271	770/ 606	1.02/0	-0.52 /0	0.0070 Ω Ω10/-	-0.14/0 _0 1/0/
2002.310	<u>4</u> <u>4</u> 070.13	0.020	262 0/52	770/ 226	1 86%	-0.00 %	0.3170	-0.14/0 _0 130/
2003	1.120 1 7 2001/1	0.024	202.3400	7706 022	1.00 /0	-0.03 /0	0.70%	-0.13/0 0.220/
2000.000	44990	0.020	200.0002	7700 995	1 200/	-0.00 /0 _0 520/	0.09%	0.20/0 _0 100/
2000.100	+307 1.38	0.020	200.101	1199.000	1.09/0	-0.52 /0	0.7170	-0.12/0

2003.25	45169.76	0.624	264.2111	7805.478	1.90%	-0.39%	0.84%	0.00%
2003.333	45312	0.624	264.6379	7812.492	1.91%	-0.24%	1.07%	0.12%
2003.416	45510.13	0.623	265.0677	7820.608	1.92%	-0.06%	1.40%	-0.24%
2003.5	45737.3	0.623	265.5011	7829.51	1.93%	0.14%	1.81%	0.00%
2003.583	45957	0.621	265.9383	7838.878	1.94%	0.34%	2.27%	-0.23%
2003.666	46139.3	0.621	266.3798	7848.394	1.95%	0.54%	2.72%	-0.23%
2003.75	46280.62	0.62	266.8259	7857.74	1.96%	0.73%	3.13%	-0.70%
2003.833	46384	0.621	267.2771	7866.599	1.97%	0.89%	3.40%	-0.22%
2003.916	46454.79	0.623	267.7338	7874.651	1.98%	1.03%	3.52%	0.26%
2004	46507.76	0.622	268.1963	7881.579	2.00%	1.12%	3.52%	0.26%
2004.083	46560	0.623	268.6648	7887.113	2.01%	1.17%	3.48%	0.26%
2004.166	46625.5	0.623	269.1387	7891.183	2.03%	1.17%	3.45%	0.27%
2004.25	46705.73	0.622	269.6172	7893.766	2.05%	1.13%	3.40%	0.27%
2004.333	46799	0.623	270.0993	7894.841	2.06%	1.05%	3.28%	0.40%
2004.416	46902.42	0.623	270.5843	7894.386	2.08%	0.94%	3.06%	0.52%
2004 5	47008 12	0.624	271 0713	7892 378	2 10%	0.80%	2 78%	0.64%
2004 583	47107	0.625	271 5595	7888 796	2 11%	0.64%	2 50%	1 01%
2004 666	47194 56	0.624	272 048	7883 617	2 13%	0.45%	2 29%	0.89%
2004 75	47284 71	0.623	272 5359	7876.82	2.10%	0.10%	2 17%	0.00%
2004 833	47396	0.623	273 0224	7868 383	2.14%	0.24%	2.17%	0.00%
2004.000	47537 99	0.625	273 5067	7858 283	2.10%	-0.21%	2.10%	0.78%
2004.010	47684.4	0.624	273 988	7846 5	2.10%	-0.21%	2.53%	0.70%
2005	47800	0.624	274 4654	7833 086	2.10%	-0.40%	2.55%	0.70%
2005.005	47862.05	0.624	274.9387	7818 403	2.10%	-0.03%	2.00%	0.00%
2005.100	47807.81	0.024	275 4075	7802 885	2.10%	-0.92%	2.05%	0.00%
2005.25	47097.01	0.024	275 8716	7786.07	2.15%	-1.15%	2.55%	1.02%
2005.555	48036 61	0.027	276 3307	7771 003	2.14/0	1 56%	2.40%	1.02 /0
2005.410	40030.01	0.020	270.3307	7755.60	2.12/0	-1.50%	2.42/0	0 200/
2005.5	40142.00	0.027	270.7040	7741 107	2.11%	-1.73/0	2.41/0	0.09/0
2005.565	40220	0.020	277.6755	7729.051	2.09%	-1.07 /0	2.30%	0.00 /0
2005.000	40270.47	0.029	277.0700	7716 699	2.07%	-1.97 %	2.20%	1.1270
2005.75	40303	0.020	270.112	7710.000	2.05%	-2.03%	2.10%	1.1170
2005.033	40301	0.620	270.0423	7707.343	2.02%	-2.04%	2.00%	1.11%
2005.916	40329.32	0.627	270.9001	7701.052	2.00%	-2.00%	2.09%	0.74%
2006	40700.13	0.626	279.3031	7697.653	1.97%	-1.90%	2.15%	0.97%
2006.083	48850	0.629	279.7932	7697.607	1.94%	-1.73%	2.21%	1.09%
2006.166	48926.55	0.63	280.1962	7700.488	1.91%	-1.51%	2.22%	1.20%
2006.25	48930.06	0.631	280.5923	7705.695	1.88%	-1.25%	2.16%	1.31%
2006.333	48891	0.63	280.9813	7712.627	1.85%	-0.95%	1.97%	0.82%
2006.416	48835.56	0.631	281.3633	7720.685	1.82%	-0.65%	1.66%	0.81%
2006.5	48796.69	0.631	281.7384	7729.268	1.79%	-0.34%	1.36%	0.93%
2006.583	48809	0.63	282.1065	//3/.//5	1.76%	-0.04%	1.20%	0.68%
2006.666	48891.05	0.631	282.4676	//45.60/	1.73%	0.23%	1.29%	0.67%
2006.75	48997.02	0.631	282.8217	//52.162	1.69%	0.46%	1.43%	0.78%
2006.833	49065	0.633	283.1689	7756.84	1.66%	0.64%	1.41%	1.01%
2006.916	49054.02	0.633	283.509	/759.042	1.63%	0.75%	1.08%	1.12%
2007	49006.8	0.634	283.8422	//58.166	1.60%	0.79%	0.61%	1.12%
2007.083	48987	0.633	284.1681	/753.727	1.56%	0.73%	0.27%	0.87%
2007.166	49040.59	0.633	284.4852	7745.702	1.53%	0.59%	0.23%	0.74%
2007.25	49142.75	0.633	284.7918	7734.179	1.50%	0.37%	0.43%	0.61%
2007.333	49251	0.63	285.086	7719.251	1.46%	0.09%	0.74%	0.37%
2007.416	49332.75	0.63	285.3661	7701.007	1.42%	-0.25%	1.02%	0.24%
2007.5	49395.08	0.63	285.6303	7679.539	1.38%	-0.64%	1.23%	0.23%

2007.583	49455	0.629	285.8768	7654.936	1.34%	-1.07%	1.32%	0.22%
2007.666	49518.97	0.627	286.1039	7627.29	1.29%	-1.53%	1.28%	-0.15%
2007.75	49551.36	0.629	286.3098	7596.691	1.23%	-2.01%	1.13%	0.07%
2007.833	49506	0.627	286.4927	7563.229	1.17%	-2.50%	0.90%	-0.42%
2007.916	49359.62	0.629	286.6511	7526.996	1.11%	-2.99%	0.62%	-0.20%
2008	49180.55	0.627	286.783	7488.082	1.04%	-3.48%	0.35%	-0.57%
2008.083	49060	0.629	286.8876	7446.7	0.96%	-3.96%	0.15%	-0.23%
2008.166	49060.83	0.628	286.9671	7403.553	0.87%	-4.42%	0.04%	-0.37%
2008.25	49132.47	0.627	287.0246	7359.468	0.78%	-4.84%	-0.02%	-0.51%
2008.333	49196	0.627	287.0632	7315.271	0.69%	-5.23%	-0.11%	-0.18%
2008.416	49183.31	0.625	287.0859	7271.787	0.60%	-5.57%	-0.30%	-0.44%
2008.5	49069.63	0.624	287.0958	7229.844	0.51%	-5.86%	-0.66%	-0.59%
2008.583	48841	0.622	287.0958	7190.266	0.43%	-6.07%	-1.24%	-0.73%
2008.666	48497.22	0.62	287.089	7153.881	0.34%	-6.21%	-2.06%	-0.75%
2008.75	48093.05	0.619	287.0784	7121.514	0.27%	-6.26%	-2.94%	-1.13%
2008 833	47697	0.617	287 0671	7093 991	0.20%	-6 20%	-3 65%	-1 15%
2008 916	47366 41	0.614	287 0579	7072 139	0.14%	-6.04%	-4 04%	-1 75%
2009	47113 92	0.61	287 054	7056 784	0.09%	-5 76%	-4 20%	-2 01%
2009 083	46941	0.606	287 0576	7048 45	0.06%	-5.35%	-4.32%	-2 73%
2009 166	46844 18	0.603	287 0689	7046 464	0.00%	-4 82%	-4 52%	-2.98%
2009 25	46800 24	0.599	287 0875	7040.404	0.04%	-4 21%	-4 75%	-3.34%
2000.20	46781	0.505	287 1129	7057 626	0.02%	-3 52%	-4.01%	-3.46%
2000.000	46767 04	0.596	287 1448	7068 823	0.02%	-2 79%	-4.91%	-3.47%
2000.410	46773 03	0.500	287 1825	7082 463	0.02%	-2.75%	-4.68%	-3.60%
2009.5	46826	0.594	287 2258	7002.403	0.05%	-2.07%	-4.13%	-3.00%
2009.505	46035 48	0.595	287 2741	7113 166	0.00%	-0.57%	-3 22%	-3.49%
2000.000	47066 22	0.501	207.2741	7128 278	0.00%	0.07%	-2 14%	-3.86%
2009.75	47000.22	0.507	207.3271	71/1 028	0.03%	0.68%	-2.1470	-3.86%
2009.000	47170	0.585	207.3043	7153 1/	0.11%	1 15%	-1.10%	-3.00%
2009.910	47214.90	0.500	207.4455	7160.030	0.15%	1.1370	-0.32 /0	-3.39%
2010	47234.92	0.505	207.5090	7164 577	0.10%	1.40%	0.20%	-5.20%
2010.003	47200	0.585	207.577	7164.077	0.10%	1.00%	0.72/0	-2.00%
2010.100	47504.07	0.585	207.0475	7160.260	0.20%	1.07 /0	1.15%	-2.19/0
2010.25	47522.17	0.565	207.7217	7100.209	0.22 /0	1.57 /0	1.04 /0	-1.70%
2010.333	47049	0.507	201.1991	7100.110	0.24%	1.00%	1.00%	-1.32%
2010.410	47700.05	0.500	207.0010	7143.100	0.20%	1.00%	2.07%	-1.19%
2010.5	47799.00	0.565	207.9000	7130.760	0.27%	0.00%	2.19%	-1.07%
2010.565	4/0/3	0.505	200.0099	7110.404	0.29%	0.27%	2.24%	-0.94%
2010.000	4/9/3.01	0.500	200.1000	7 100.404	0.31%	-0.10%	2.21%	-0.30%
2010.75	40000.30	0.565	200.2000	7005.103	0.32%	-0.03%	2.11%	-0.17%
2010.833	48077	0.583	288.3002	7005.137	0.34%	-1.08%	1.92%	-0.17%
2010.916	47992.54	0.582	200.40	7040.001	0.36%	-1.49%	1.05%	-0.42%
2011	4/8/3.53	0.583	288.6001	7028.153	0.38%	-1.85%	1.35%	0.09%
2011.083	47811	0.583	288.7267	7009.962	0.40%	-2.16%	1.12%	-0.16%
2011.166	47866.5	0.584	288.8595	6992.258	0.42%	-2.40%	1.02%	-0.02%
2011.25	47983.74	0.584	288.9979	6975.166	0.44%	-2.59%	0.97%	-0.02%
2011.333	48077	0.584	289.1415	6958.81	0.47%	-2.72%	0.90%	-0.27%
2011.416	48087.44	0.583	289.2897	0943.314	0.49%	-2.80%	0.74%	-0.26%
2011.5	48063.87	0.582	289.4421	0928.804	0.51%	-2.83%	0.55%	-0.26%
2011.583	48082	0.582	289.5981	og15.402	0.53%	-2.82%	0.44%	-0.25%
2011.666	48194.77	0.583	289.7573	6903.234	0.56%	-2.78%	0.46%	-0.25%
2011.75	48364.07	0.584	289.9192	6892.424	0.58%	-2.69%	0.63%	0.02%
2011.833	48529	0.584	290.0832	6883.096	0.60%	-2.58%	0.94%	0.28%

2011.916	48642.83	0.586	290.2489	6875.375	0.61%	-2.43%	1.35%	0.67%
2012	48715.48	0.586	290.4159	6869.385	0.63%	-2.26%	1.76%	0.54%
2012.083	48771	0.584	290.5835	6865.207	0.64%	-2.06%	2.01%	0.29%
2012.166	48827.59	0.585	290.7512	6862.748	0.65%	-1.85%	2.01%	0.29%
2012.25	48879.98	0.586	290.9182	6861.869	0.66%	-1.62%	1.87%	0.42%
2012.333	48917	0.585	291.0838	6862.433	0.67%	-1.38%	1.75%	0.30%
2012.416	48929.6	0.585	291.2474	6864.304	0.68%	-1.14%	1.75%	0.43%
2012.5	48917.12	0.586	291.4081	6867.343	0.68%	-0.89%	1.78%	0.69%
2012.583	48881	0.585	291.5654	6871.414	0.68%	-0.64%	1.66%	0.56%
2012.666	48828.29	0.584	291.7185	6876.379	0.68%	-0.39%	1.31%	0.30%
2012.75	48788.56	0.587	291.8667	6882.101	0.67%	-0.15%	0.88%	0.55%
2012.833	48797	0.588	292.0094	6888.442	0.66%	0.08%	0.55%	0.68%
2012.916	48874.08	0.587	292.1458	6895.265	0.65%	0.29%	0.48%	0.29%
2013	48981.44	0.586	292.2752	6902.433	0.64%	0.48%	0.55%	0.16%
2013.083	49066	0.585	292.3971	6909.803	0.62%	0.65%	0.60%	0.28%
2013.166	49090.69	0.586	292.5116	6917.214	0.61%	0.79%	0.54%	0.28%
2013.25	49082.39	0.585	292.6189	6924.498	0.58%	0.91%	0.41%	0.02%
2013.333	49084	0.586	292.7193	6931.488	0.56%	1.01%	0.34%	0.27%
2013.416	49130.58	0.586	292.813	6938.018	0.54%	1.07%	0.41%	0.26%
2013.5	49225.92	0.586	292.9002	6943.921	0.51%	1.12%	0.63%	0.13%
2013.583	49366	0.587	292.9813	6949.029	0.49%	1.13%	0.99%	0.38%
2013.666	49536.96	0.587	293.0564	6953.177	0.46%	1.12%	1.45%	0.50%
2013.75	49685.63	0.587	293.1257	6956.196	0.43%	1.08%	1.84%	0.11%
2013.833	49749	0.583	293.1896	6957.919	0.40%	1.01%	1.95%	-0.54%
2013.916	49690.77	0.586	293.2482	6958.181	0.38%	0.91%	1.67%	-0.03%
2014	49581.39	0.586	293.3018	6956.814	0.35%	0.79%	1.22%	0.09%

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