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The Full Value of the Nobel Prize - Part 1: Mining “Data Without Theory”

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Abstract: This paper comes in two parts, this being the first. Part 1 is not a research paper in the sense of the Scientific Method; it is rather unsophisticated data mining - a cheap data mining exercise for that matter, because it does not follow any received economic, or other, theory. In the sense of Ed E. Leamer, it is “data without theory,” and data without theory does not speak for itself, despite the common cliché of “letting the data speak for itself.” The objective here is to adjust the money value of the Nobel Prize to include the values of the Nobel Prize medal and diploma. It is an arithmetic exercise that reveals that Alfred Nobel’s monetary contribution to humanity is huge. More importantly, the calculations generate data that make it possible to focus on the economic implications of Nobel’s bequest for human capital accumulation, technological progress, and long-run economic growth, which are subjects of a separate effort in Part 2. In this “paper” I indicate some basic relationships among and between key variables in Section 4, and remark in the last section that the Nobel Prize is a massive contribution, even without taking into account the time value of money. For instance, the unadjusted value of the Economics Nobel Prize in 1969 awarded to Ragnar Frisch and Jan Tinbergen was only 2.92 million SEK (US\$0.57 million), but adjusted for the medal and diploma values the award was 5.85 million SEK (US\$1.14 million).

Keywords: Nobel Prize full value, Nobel Prize and human development, nobel prize and human capital, Nobel Prize and technological change, Nobel Prize and economic performance. **JEL Code:** Y1, C80, D60, D83, O15, O43

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1. Introduction

Although not the largest in monetary terms, the Nobel Prize ranks high among the most prestigious recognitions in the world.¹ In Physics, Chemistry, Physiology or Medicine, Literature, and Economics, the Nobel Prize confers the highest academic honor, higher than even the most valuable Ph.D. from the most prestigious Ivy League university. In his Nobel Prize address Dr. Ahmed Zewail (1999) asserts that “to the world, the Nobel Prize has become the crowning honor

¹For a partial list of “Famous Trophies and Awards” see <http://www.mickeys.net/hi-famous-trophies.htm>. Robert Finn’s “Eponymous Prizes Honor Scientists, But Draw Criticism” examples at <http://f1000scientist.com/article/display/17995/>, including a surprising fact that Alfred Nobel once won the Franklin Institute’s Casson Medal which might have inspired his bequest.

for two reasons. For scientists, it recognizes their untiring efforts which lead to new fields of discovery, and places them in the annals of history with other notable scientists. For science, the Prize inspires the people of the world about the *importance and value of new discoveries*, and in so doing science becomes better appreciated and supported by the public, and , hopefully, by governments” (p.2). This interpretation is consistent with Alfred Nobel’s will that “... interest capital invested in safe securities ... be annually distributed in the form of prizes to those who, during the preceding year, shall have conferred the greatest benefit to mankind” (http://nobelprize.org/nobel_organizations/nobelfoundation/statutes.html).

Qualitatively each Nobel Prize laureate represents a contribution to humanity – at least in the eyes of the Prize awarding institutions. Quantitatively, however, it is still an open question about what the cumulative *benefit* of the Nobel Prize to “mankind” is to-date. To answer that question in a substantial way one has to know the *full value*, not just the partial value, of the Nobel Prize.² Figuring out the full value of the Prize is largely a subjective undertaking. For example, the 2009 Nobel Peace Prize awarded to the U.S. President Barrack Obama raised a number of illustrative issues relating to the real value of the award. One, some people thought President Obama did not meet Alfred Nobel’s requirement, and therefore giving him the Prize somehow reduced the full value of the Nobel Prize in general. Second, others evaluate Nobel Prizes differently depending on the prize category. The full value of the “Economics Nobel Prize,” for instance, has been questioned for a while now. Part of the skepticism stems from the fact that the official Swedish name for the Nobel Prize in Economics, The *Sveriges Riksbank pris I ekonomisk vetenskap till Alfred Nobels minne*, has been translated variously in English since it was first awarded in 1969 as Table 1 below shows.

Table 1 - Various names for the “Economics Nobel Prize” over the Years

Year	English translation of official name
1969-1970	Prize in Economic Science Dedicated to the Memory of Alfred Nobel
1971	Prize in Economic Science
1972	Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel
1973-1975	Prize in Economic Science in Memory of Alfred Nobel
1976-1977	Prize in Economic Sciences in Memory of Alfred Nobel
1978-1981	Alfred Nobel Memorial Prize in Economic Sciences
1982	Alfred Nobel Memorial Prize in Economic Science
1983	Prize in Economic Sciences in Memory of Alfred Nobel

²Throughout this exercise I use the word *full* to capture simultaneously the *arithmetic* sense of *completeness* as well as the economic sense of *reality*.

Year	English translation of official name
1984-1990	Alfred Nobel Memorial Prize in Economic Sciences
1991	<i>Sveriges Riksbank</i> (Bank of Sweden) Prize in Economic Sciences in Memory of Alfred Nobel
1992-2005	Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel
2006-Present	The <i>Sveriges Riksbank</i> Prize in Economic Sciences in Memory of Alfred Nobel

Source: http://en.wikipedia.org/wiki/Nobel_Memorial_Prize_in_Economic_Sciences.

As one of its ferocious critics, Peter Soderbaum (2010) has argued that “Nobel economics” is nothing but a neoclassical ideology cloaked in value-free pretense while its principal goal is to understand human values and the values human beings put on the things they do – their behavior and activities. He charges that the monopoly of neoclassical economics is a danger that must be abandoned or changed to reflect both competing and complementary alternatives, and he firmly concludes that there is no reason for rewarding monopoly because economic theory admits that monopolies are inefficient and sometimes even unfair (cf. Hazel Henderson, 2004). Soderbaum’s critique, however, does not take into account the Nobel Prize awarded to Gunnar Myrdal, for example, whose work clearly acknowledges the role of value-judgment in economic research, and has articulated that view in his *Objectivity in Social Research* (1969).

Criticisms against the value of the “Economics Nobel Prize,” and whether there should even be a Nobel Prize for Economics, have been confounded by events within and outside the profession itself. From within even some Nobel winners like William Vickery and F.A. Hayek doubt the cumulative effects of economics in general, and its significance to human welfare particularly.³ Cassidy (1996), and Brittan (2003) make general remarks on this argument which give some direction for further reading. From outside the profession, presumably the Economics Nobel reduces the value of “the real Nobel Prize,” because “economists’ hands [are] dirty” (http://www.france24.com/en/20081013-should-nobel-prize-economics-be-abolished-nobel-prize?quicktabs_1=1#). For one example of what is wrong with economics, critics point to Long Term Capital Management, a hedge fund firm founded by 1997 Nobel economists Robert C. Merton and Myron Scholes, which lost over \$4.5 billion when it collapsed. Merton and Scholes, along with Fischer Black invented the formula for pricing options. While there is now sufficient evidence that theoretical economics has distanced itself from its social foundations (see Amavilah, 2010) by avoiding debate on the moral issues of the science (see Bhagwati, 2011, et. al.), economics and economists are no more to blame for economic crises than physics and chemistry are to be blamed for the casualties of war, literature is for nightmares, the Nobel Peace Prize is for continued

³Professors William Vickery and F.A. von Hayek received the Economics Nobel Prize in 1996 and 1974, respectively.

hostilities around the world, or physiology and medicine are for the failure to end HIV/AIDS. Thus, the calls for the abolition of the Economics Nobel Prize are unreasonable if they were based on that ground alone.

Before getting too excited, let us reset. This essay is not a research essay in the sense of Scientific Method. It is rather a data mining exercise - generating “data without theory” as Ed Leamer (1983, 1995) would have said. It is however not an aimless exercise; its immediate objective is to calculate the *full* value of the Nobel Prize. The calculations, and especially the information they generate, can then be used to assess the impact of the Nobel Prize on human welfare, which was Alfred Nobel’s original intention. Again, I cannot possibly accomplish all that in this paper. Instead, Section 2 below describes the Nobel Prize partial money value across eligible categories over time. In subsequent sections I try to calculate the values of the Nobel medal and diploma, and add the results to the full value of the Economics Nobel Prize as an illustration. In the end I speculate about stylized channels through which prizes like the Nobel Prize can affect human capital accumulation, technological change, and long-run economic growth. This theoretical speculation is followed by a concluding remark in the last section, which will also form the beginning of Part 2 of this exercise.

2. The Timeless Money Value of the Nobel Prize

The money amount of the Nobel Prize that one often hears about is a partial, not full, value of the Nobel Prize. Nobel Prize winners also receive medals and diplomas. But first things first. Table 2 presents basic statistics about the number of times the Nobel Prize has been awarded since 1901. Only on fifty occasions was the Nobel Prize not awarded, and most of those occasions were during war years.⁴ In total the Nobel Prize has been given 543 times to 813 individual and 20 organizations its debut. The five original (real) Nobel Prize categories (Physics, Chemistry, Literature, Medicine/Physiology, and Peace) have received the most prizes most times, with the Peace category ranking lowest in that group. Economic Sciences have received the fewest prizes, but that is because it was only added as a category in 1969. The table reveals that in Literature the ratio of individual winners to multiple winners is 25:1, while in Chemistry it is 2:1. There are more multiple winners in Physics than individual winners, whereas for Medicine/Physiology and Economic Sciences the ratios are just about even.

Again, it is common knowledge that early awards went to Physics, Chemistry, Physiology or Medicine, Literature, and Peace. The Memorial Nobel Prize in Economic Sciences is the latest addition, but of no less significance. In fact, given the controversies surrounding it, the Economics Nobel Prize is clearly a Keynesian demonstration that “the ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than commonly understood. Indeed the world is ruled by little else. Practical men, who believe themselves to be quite

⁴For a list of those years see http://nobelprize.org/nobel_prizes/nobelprize_facts.html. However, since the money was available, I argue the investment was fully made.

Table 2- Number of Times the Nobel Prize Has Been Awarded Since 1901

Category	One Winner	Two Winners	More than Two Winners	Total
Physics	47	29	28	104
Chemistry	62	22	18	102
Medicine/Physiology	38	31	32	101
Literature	99	04	00	103
Peace	62	28	01	091
Economic Sciences	22	15	05	042
Total	330	129	84	543

Data Source: http://nobelprize.org/faq/nobel_prize.html, and http://nobelprize.org/nobel_prizes/nobelprize_facts.html.

exempt from any intellectual influences, are usually the slaves of some defunct economist” (Keynes, 1936, p. 383).

The next set of tables characterize the monetary value of the Nobel Prize since its inception. Column 2 of Table 3 shows the nominal value of an individual award in Swedish Kronors (SEK).⁵ For example, in 1901 a winner received 150,782 SEK, which is an equivalent of 7.9 million in 2009 SEK (Column 2 of Table 4). In other words, the 0.151 million SEK awarded in 1901 cumulated to 219.8 million by 2010 in 2009 SEK. For additional perspective, the Nobel Prize-awarding body spent 60 million SEK on awards in 1901 and 1.32 billion SEK cumulatively by 2010. On a per capita basis there are very few countries around the world that have spent that much money on a single source of human capital accumulation.

Table 4 converts Table 3 into 2009 SEK. Another example: In 1970 each Nobel Prize category received 2.9 million SEK and cost the Nobel Prize Foundation 17 million SEK across all six categories. In cumulative terms and 2009 SEK, the former was really 266 million SEK while the later is 1.6 billion SEK. Again, an individual winner in 2010 received 10.3 million SEK, but by this time the Nobel Foundation had spent 3.2 billion SEK on all awards since 1901. An impressive amount, indeed!

⁵An individual money award is equally shared by the winners in that category.

Table 3 - Money Value of Nobel Prize, SEK – 1901-2010

Year	(a) Nominal Prize Value	(b) Cumulative Nominal Prize Value	(c) Prize Expenditure	(d) Cumulative Prize Expenditure
1901	150782	150782	753910	753910
1902	141847	292629	709235	1463145
1903	141358	306714	706790	1533570
1904	140859	444803	704295	2224015
1905	138089	583339	690445	2916695
1906	138536	722135	692680	3610675
1907	138796	861935	693980	4309675
1908	139800	1001735	699000	5008675
1909	139800	1142438	699000	5712190
1910	140703	1283133	703515	6415665
1911	140695	1423609	703475	7118045
1912	140476	1567619	702380	7838095
1913	143010	1714519	715950	8572595
1914	146900	1863742	734500	9318710
1915	149223	1995535	746115	9977675
1916	131793	2129358	658965	10646790
1917	133823	2267556	669115	11337780
1918	138198	2400683	690990	12003415
1919	133127	2534783	665635	12673915
1920	134100	2656356	670500	13281780
1921	121573	2778839	607865	13894195
1922	122483	2893774	612415	14468870
1923	114935	3010493	574675	15052465

Year	(a) Nominal Prize Value	(b) Cumulative Nominal Prize Value	(c) Prize Expenditure	(d) Cumulative Prize Expenditure
1924	116719	3128658	583595	15643290
1925	118165	3245618	590825	16228090
1926	116960	3372119	584800	16860595
1927	126501	3529058	632505	17645290
1928	156939	3701818	784695	18509090
1929	172760	3874765	863800	19373825
1930	172947	4047971	864735	20239855
1931	173206	4219724	866030	21098620
1932	171753	4390056	858765	21950280
1933	170332	4552664	851660	22763320
1934	162608	4712581	813040	23562905
1935	159917	4872431	799585	24362155
1936	159850	5030894	799250	25154470
1937	158463	5185971	792340	25929855
1938	155077	5334793	775385	26673965
1939	148822	5473363	744110	27366815
1940	138570	5604859	692850	28024295
1941	131496	5736750	657480	28683750
1942	131891	5860441	659455	29302205
1943	123691	5982282	618455	29911410
1944	121841	6103615	609205	30518075
1945	121333	6225139	606665	31125695
1946	121524	6371254	607620	31856270
1947	146115	6531027	730575	32655135
1948	159773	6687317	798865	33436585

Year	(a) Nominal Prize Value	(b) Cumulative Nominal Prize Value	(c) Prize Expenditure	(d) Cumulative Prize Expenditure
1949	156290	6851621	781450	34258105
1950	164304	7019233	821520	35096165
1951	167612	7190368	838060	35951840
1952	171135	7365661	855675	36828305
1953	175293	7547308	876465	37736540
1954	181647	7737522	908235	38687610
1955	190214	7937645	951070	39688225
1956	200123	8146274	1000615	40731370
1957	208629	8366952	1040615	41834769
1958	214559	8592939	1072795	42964695
1959	220678	8843172	1103390	44215860
1960	225987	9100392	1129935	45501960
1961	250233	9357612	1251165	46788060
1962	257220	9622612	1286100	48113060
1963	265000	9895612	1325000	49478069
1964	273000	10177612	1365000	50888060
1965	282000	10477612	1410000	52388060
1966	300000	10797612	1500000	53988060
1967	320000	11147612	1600000	55738060
1968	350000	11522612	1750000	57613060
1969	375000	11922612	2250000	71535672
1970	400000	12372612	2400000	74235672
1971	450000	12852612	2700000	77115672
1972	480000	13362612	2880000	80175672
1973	510000	13912612	3060000	83475672

Year	(a) Nominal Prize Value	(b) Cumulative Nominal Prize Value	(c) Prize Expenditure	(d) Cumulative Prize Expenditure
1974	550000	14542612	3300000	87255672
1975	630000	15223612	3780000	91341672
1976	681000	15923612	4086000	95541672
1977	700000	16648612	4200000	99891672
1978	725000	17448612	4350000	104691672
1979	800000	18328612	4800000	109971672
1980	880000	19328612	5280000	115971672
1981	1000000	20478612	6000000	122871672
1982	1150000	21978612	6900000	131871672
1983	1500000	23628612	9000000	141771672
1984	1650000	25428612	9900000	152571672
1985	1800000	27428612	10800000	164571672
1986	2000000	29603612	12000000	177621672
1987	2175000	32103612	13050000	192621672
1988	2500000	35103612	15000000	210621672
1989	3000000	39103612	18000000	234621672
1990	4000000	45103612	24000000	270621672
1991	6000000	51603612	36000000	309621672
1992	6500000	58303612	39000000	349821672
1993	6700000	65303612	40200000	391821672
1994	7000000	72503612	42000000	435021672
1995	7200000	79903612	43200000	479421672
1996	7400000	87403612	44400000	524421672
1997	7500000	95303612	45000000	571821672
1998	7600000	102903612	45600000	617421672

Year	(a) Nominal Prize Value	(b) Cumulative Nominal Prize Value	(c) Prize Expenditure	(d) Cumulative Prize Expenditure
1999	7900000	110803612	47400000	664821672
2000	9000000	119803612	54000000	718821672
2001	10000000	129803612	60000000	778821672
2002	10000000	139803612	60000000	838821672
2003	10000000	149803612	60000000	898821672
2004	10000000	159803612	60000000	958821672
2005	10000000	169803612	60000000	1018821672
2006	10000000	179803612	60000000	1078821672
2007	10000000	189803612	60000000	1138821672
2008	10000000	199803612	60000000	1198821672
2009	10000000	209803612	60000000	1258821672
2010	10000000	219803612	60000000	1318821672

Note: (a) is the nominal amount awarded to each winner that year; (b) is cumulative (a); (c) is (a) times the number of categories that won that year (There were *five* categories until 1968 and *six* categories from 1969 onwards.); and (d) is cumulative (c)

Data Source: http://nobelprize.org/nobel_prizes/literature/amount.html.

Table 4 - Monetary Value of Nobel Prize in 2009 SEK – 1901-2010

Year	(a) Monetary Prize Value	(b) Cumulative Monetary Prize Value	(c) Monetary Prize Expenditure	(d) Cumulative Monetary Prize Expenditure
1901	7872648	7872648	39363240	39363240
1902	7406133	15278781	37030665	76393905
1903	7163525	22442306	35817625	112211530
1904	7138237	29580543	35691185	147902715
1905	6997863	36578406	34989315	182892030
1906	6819929	43398335	34099645	216991675
1907	6463392	49861727	32316960	249308635
1908	6510146	56371873	32550730	281859365
1909	6510146	62924069	32550730	314410095
1910	6552196	69657888	32760980	347171075
1911	6733819	75864046	33669095	380840170
1912	6206158	85182154	31590540	412430710
1913	6318108	88672121	32449835	444880545
1914	6489967	94385704	31030790	475911335
1915	5713583	98838240	28567915	504479250
1916	4452536	98838276	22262680	526741930
1917	3602766	102441042	18013832	544755760
1918	2616650	105057692	13083250	557839010
1919	2184551	107242243	10922755	568761765
1920	2200517	109442760	11002585	579764350
1921	2327448	111770208	11637240	591401590
1922	2890934	114661142	14454670	605856260
1923	2912250	117573392	14561250	620417510

Year	(a) Monetary Prize Value	(b) Cumulative Monetary Prize Value	(c) Monetary Prize Expenditure	(d) Cumulative Monetary Prize Expenditure
1924	2957453	120530845	14787265	635204775
1925	2950700	123481545	14753500	649958275
1926	3007792	126489337	15038960	664997235
1927	3302443	129791780	16512215	681509450
1928	4097059	134888839	20485295	701994745
1929	4510083	139398922	22550415	724545160
1930	4656058	144054980	23280290	747825450
1931	4813451	148868331	24067255	771892705
1932	4851318	153719649	24256590	796149295
1933	4974272	158693921	24817136	1044320655
1934	4748705	163442626	23743525	1068064180
1935	4592283	168034909	22961415	1091025595
1936	4515107	172550016	22575535	1113601130
1937	4333837	176883853	21669185	1135270315
1938	4174964	181058817	20874820	1156145135
1939	3885156	184943973	19425780	1175570915
1940	3226434	188170407	16132170	1191703085
1941	2697233	191867740	13486165	1205189250
1942	2524980	194392720	12624900	1217814150
1943	2316517	196709237	11582585	1229396735
1944	2306946	199016183	11534730	1240931465
1945	2297327	201313510	11486635	1252418100
1946	2300943	203614453	11504715	1263922815
1947	2678257	206292710	13391285	1277314100

Year	(a) Monetary Prize Value	(b) Cumulative Monetary Prize Value	(c) Monetary Prize Expenditure	(d) Cumulative Monetary Prize Expenditure
1948	2809070	209101780	14045350	1291359450
1949	2692877	211794657	13464385	1304823835
1950	2802929	214597586	14014645	1318838400
1951	2468337	217065923	12341685	1331180165
1952	2340203	219406126	11701015	1342881180
1953	2359608	221765734	11798040	1354679220
1954	2426184	224191818	12130920	1366810140
1955	2464201	226656019	12321005	1379131145
1956	2480661	229136680	12403305	1391534450
1957	2479088	231615768	12395440	1403929890
1958	2432139	234047907	12160695	1416090585
1959	2485152	236533059	12425760	1428516345
1960	2448903	238981962	12244516	1440760861
1961	2645101	241627063	13225505	1453986366
1962	2607000	244234063	13035000	1467021366
1963	2609114	246843177	13045570	1480066936
1964	2598779	249441956	12993895	1493060831
1965	2557295	251999251	12786475	1505847306
1966	2558911	254558162	12794555	1518641861
1967	2613081	257171243	13065405	1531707266
1968	2804884	259976127	14024420	1545731686
1969	2923643	262899770	17541858	1563273544
1970	2920339	265820109	17522034	1580795578
1971	3052559	268872668	18315354	1599110932

Year	(a) Monetary Prize Value	(b) Cumulative Monetary Prize Value	(c) Monetary Prize Expenditure	(d) Cumulative Monetary Prize Expenditure
1972	3074498	271947166	18446988	1617557920
1973	3061777	272008943	18370662	1635928582
1974	2998892	278007835	17993352	1653921934
1975	3128213	281136048	18769278	1672691212
1976	3071631	284207679	18429786	1691120998
1977	2831221	286871165	16987326	1708108324
1978	2663486	289616982	15980916	1724089240
1979	2745817	292272394	16474902	1740564142
1980	2655412	294964582	15932472	1756496614
1981	2692188	297815589	16153128	1772649742
1982	2851007	301229724	17106042	1789755784
1983	3414135	304705213	20484810	1810240594
1984	3475389	308237559	20852934	1831093528
1985	3532346	312003679	21194076	1852287604
1986	3766120	315931902	21194076	1873481680
1987	3928223	320200980	22596720	1896078400
1988	4269078	325018315	25614468	1921692868
1989	4817335	330832349	28904010	1950596878
1990	5816034	338803051	34896204	1985493082
1991	7970702	347242765	47824212	1990275494
1992	8439714	355553852	50638284	2040913778
1993	8311087	364053500	49866522	2090780300
1994	8499648	372579686	50997888	2141778188
1995	8526186	381300743	51157116	2192935304

Year	(a) Monetary Prize Value	(b) Cumulative Monetary Prize Value	(c) Monetary Prize Expenditure	(d) Cumulative Monetary Prize Expenditure
1996	8721067	390097544	52326402	2245261706
1997	8796801	399023788	52780806	2298042512
1998	8926244	408258320	53557464	2351599976
1999	9234532	418672692	55407192	2407007168
2000	10414372	429971053	62486232	2469493430
2001	11298361	441030103	67790166	2537283596
2002	11059050	451880229	66354300	2603637896
2003	10850126	462689514	65100756	2668738652
2004	10809285	473451538	64855710	2733594362
2005	10762024	483989764	64572144	2798166506
2006	10538226	494172979	63229356	2861395862
2007	10183215	504266711	61099290	2922495152
2008	10093732	514449139	60562392	2983057544
2009	10182428	524720262	61094568	3044152112
2010	10271123	528918024	61626738	3105778850

Note: (a) is the prize awarded in 2009 SEK; (b) is cumulative (a); (c) is (a) times the categories that won that year (There were five categories until 1968 and six categories from 1969 onwards.); and (d) is cumulative (c).

Data Source: http://nobelprize.org/nobel_prizes/about/prize_amounts_11.pdf.

3. The Timeless Value of the Nobel Prize by Major Components with Emphasis on Economics

3.1 Partial Money Value of the Nobel Prize (v_1)

Tables 3 and 4 show that the money value of the Nobel Prize has been impressive. Albeit impressive, this money value is only a *partial* value of the Nobel Prize as it excludes the values of the medals and

Table 5 - The Economics Nobel Prize, 1969 - 2010

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
1969	Ragnar. Frisch Tinbergen, Jan	“for having developed and applied dynamic models for the analysis of economic processes”	The Use of Models: Experience and Prospects From Utopian Theory to Practical Applications: The case of Econometrics
1970	Samuelson, Paul	“for the scientific work through which he has developed static and dynamic economic theory and actively contributed to raising the level of analysis in economic science”	Maximum Principles in Analytical Economics
1971	Kuznets, Simon	“For his empirically founded interpretation of economic growth which has led to new and deepened insight into economic and social structure and process of development”	Modern Economic Growth: Findings and Reflections

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
1972	Hicks, John	“for their pioneering contributions to general economic equilibrium theory and welfare theory”	The Mainspring of Economic Growth
	Arrow, Kenneth		General Economic Equilibrium: Purpose, Analytic Techniques, Collective Choice
1973	Leontief, Wassily	“for the development of the input-output method and for its application to important economic problems”	Structure of the World Economy
1974	Myrdal, Gunnar	“for their pioneering work in the theory of money and economic fluctuations and for their penetrating analysis of the interdependence of economic, social and institutional phenomena”	The Equality Issue in World Development
	Hayek, Friedrich		The Pretence of Knowledge
1975	Kantorovich,		Mathematics in

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
	Leonid Koopmans, Tjalling	“for their contributions to the theory of optimum allocation of resources”	Economics: Achievements, Difficulties, Perspectives Concepts of Optimality and Their Uses
1976	Friedman, Milton	“for his achievements in the fields of consumption analysis, monetary history and theory and for his demonstration of the complexity of stabilisation policy”	Inflation and Unemployment
1977	Ohlin, Bertil Meade, James	“for their pathbreaking contribution to the theory of international trade and international capital movements”	1933 and 1977 - Some Expansion Policy Problems in Cases of Unbalanced Domestic and International Economic Relations The Meaning of "Internal Balance"
1978	Simon, Herbert	“for his pioneering research into the decision-making	Rational Decision-Making in Business

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
		process within economic organizations”	Organizations
1979	Schultz, Theodore	“for their pioneering research into economic development research with particular consideration of the problems of developing countries”	The Economics of Being Poor
	Lewis, W. Arthur		The Slowing Down of the Engine of Growth
1980	Klein, Lawrence	“for his creation of econometric models and the application to the analysis of economic fluctuations and economic policies”	Some Economic Scenarios for the 1980's
1981	Tobin, James	“for his analysis of financial markets and their relations to expenditure decisions, employment, production and prices”	Money and Finance in the Macro-Economic Process
1982	Stigler, George	“for his seminal studies of	The Process and Progress of

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
		industrial structures, functioning of markets and causes and effects of public regulation”	Economics
1983	Dbreu, Gerard	“for having incorporated new analytical methods into economic theory and for his rigorous reformulation of the theory of general equilibrium”	Economic Theory in the Mathematical Mode
1984	Stone, Ruichard	“for having made fundamental contributions to the development of systems of national accounts and hence greatly improved the basis for empirical economic analysis”	The Accounts of Society
1985	Modigliani, Franco	“For his pioneering analyses of saving and of financial markets”	Life Cycle, Individual Thrift and the Wealth of Nations
1986	Buchanan, James	“for his development of	The Constitution

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
		the contractual and constitutional bases for the theory of economic and political decision-making”	of Economic Policy
1987	Solow, Robert	“for his contributions to the theory of economic growth”	Growth Theory and After
1988	Allais, Maurice	“for his pioneering contributions to the theory of markets and efficient utilization of resources”	An Outline of My Main Contributions to Economic Science
1989	Haavelmo, Trygve	“for his clarification of the probability theory foundations of econometrics and his analyses of simultaneous economic structures”	Econometrics and the Welfare State
1990	Markowitz, Harry	“for their pioneering work in the theory of financial economics”	Foundations of Portfolio Theory
	Miller, Merton		Leverage
	Sharpe, William		Capital Asset

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
			Prices with and without Negative Holdings
1991	Coase, Ronald	“for his discovery and clarification of the significance of transaction costs and property rights for the institutional structure and functioning of the economy”	The Institutional Structure of Production
1992	Becker, Gary	“for having extended the domain of microeconomic analysis to a wide range of human behaviour and interaction, including non-market behaviour”	The Economic Way of Looking at Life
1993	Fogel, Robert	“for having renewed research in economic history by applying economic theory and quantitative methods in order to explain economic and	Economic Growth, Population Theory, and Physiology: The Bearing of Long-Term Processes on the Making of Economic

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
		institutional change”	Policy
	North, Douglas		Economic Performance through Time
1994	Harshanyi, John	“for their pioneering analysis of equilibria in the theory of non-cooperative games”	Games with Incomplete Information
	Nash, John		Acceptance speech: http://www.youtube.com/watch?v=w5ToctbuBtc
	Selten, Reinhard		Multistage Game Models and Delay Supergames
1995	Lucas, Jr., Robert	“for having developed and applied the hypothesis of rational expectations, and thereby having transformed macroeconomic analysis and deepened our understanding of economic policy”	Monetary Neutrality

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
1996	Mirrlees, James	“for their fundamental contributions to the economic theory of incentives under asymmetric information”	Information and Incentives: The Economics of Carrots and Sticks
	Vickery, William		Procuring Universal Service: Putting Auction Theory to Work
1997	Merton, Robert	“for a new method to determine the value of derivatives”	Applications of Option-Pricing Theory: Twenty-Five Years Later
	Scholes, Myron		Derivatives in a Dynamic Environment
1998	Sen, Amartya	“for his contributions to welfare economics”	The Possibility of Social Choice
1999	Mundell, Robert	“for his analysis of monetary and fiscal policy under different exchange rate regimes and his analysis of optimum currency areas”	A Reconsideration of the Twentieth Century

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
2000	Heckman, James	“for his development of theory and methods for analyzing selective samples”	Microdata, Heterogeneity and the Evaluation of Public Policy
	McFadden	“for his development of theory and methods for analyzing discrete choice”	Economic Choices
2001	Akerlof, George	“for their analyses of markets with asymmetric information”	Behavioral Macroeconomics and Macroeconomic Behavior
	Spence, Michael		Signaling in Retrospect and the Informational Structure of Markets
	Stiglitz, Joseph		Information and the Change in the Paradigm in Economics
2002	Kahneman, Daniel	“for having integrated insights from psychological research into economic science, especially	Maps of Bounded Rationality

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
		concerning human judgment and decision-making under uncertainty”	
	Smith, Vernon	“for having established laboratory experiments as a tool in empirical economic analysis, especially in the study of alternative market mechanisms”	The Invention and Early History of the CCD
2003	Engle, Robert	“for methods of analyzing economic time series with time-varying volatility (ARCH)”	Risk and Volatility: Econometric Models and Financial Practice
	Granger, Clive	“For methods of analyzing economic time series with common trends (cointegration)”	Time Series Analysis, Cointegration, and Applications
2004	Kydland, Finn	“for their contributions to dynamic macroeconomics : the time consistency of economic policy and the driving forces behind	Quantitative Aggregate Theory

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
		business cycles”	
	Prescott, Edward		The Transformation of Macroeconomic Policy and Research
2005	Aumann, Robert	“for having enhanced our understanding of conflict and cooperation through game- theory analysis”	War and Peace
	Schelling, Thomas		An Astonishing Sixty Years: The Legacy of Hiroshima
2006	Phelps, Edmund	“for his analysis of intertemporal tradeoffs in macroeconomic policy”	Macroeconomic s for a Modern Economy
2007	Hurwicz, Leonid	“for having laid the foundations of mechanism design theory”	But Who Will Guard the Guardians?
	Maskin, Eric		Mechanism Design: How to Implement Social Goals
	Myerson, Roger		

Nobel Year	Nobel Laureate	Nobel Citation	Nobel Lecture
			Perspectives on Mechanism Design in Economic Theory
2008	Krugman, Paul	“for his analysis of trade patterns and location of economic activity”	The Increasing Returns Revolution in Trade and Geography
2009	Ostrom, Elinor	“for her analysis of economic governance, especially the commons”	Beyond Markets and States: Polycentric Governance of Complex Economic Systems
	Williamson, Oliver	“For his analysis of economic governance, especially the boundaries of the firm”	Transaction Cost Economics: The Natural Progression
2010	Diamond, Peter	“for their analysis of markets with search frictions”	Unemployment, Vacancies, Wages
	Mortensen, Dale		Markets with Search Frictions
	Pissarides, Christopher		Equilibrium in the Labour Market with Search Frictions

Data source: Assembled from http://nobelprize.org/nobel_prizes/economics/laureates/, and [http://en.wikipedia.org/List of Nobel laureates in Economics](http://en.wikipedia.org/List_of_Nobel_laureates_in_Economics).

diplomas which winners also receive. The objective of this part of the exercise is to compute the *full* value of the Nobel Prize, stressing the Economics Nobel, but only as an example. Table 5 describes the 42 Nobel prizes awarded to conomists since 1969. Most awards went to macroeconomists, many of them affiliated with the University of Chicago (USA). The runners-up are game theoretic economists, which has given fodder to those who argue that economics has become a useless game of trickery. The affiliation with the University of Chicago is open to the charge that economics has become an ideological cult, especially in its assumptions of market efficiency and market infallibility (perfection). These arguments feed into the accusation that economics does, and should, not belong to the family of “real Nobel” awards.

I have not read all the Economics Nobel Prize Lectures. However, the little I know has convinced that each award represents a unique and significant contribution to both the knowledge of economics and the economics of knowledge. However, if there were an equivalent “Erdos number” for economists, it would show that nearly all Nobel Prize economists are closely linked.⁶ One reading of that closeness is that Nobel Prize economics does not spread far and wide, and represent a typical case of an apple that does not fall too far from the tree. Thus, measured as the volume of a cone, the observed contribution of Nobel Prize economics to our knowledge and understanding has come mainly from increased depth; growth in the radius (reach) and base (width) has been very limited, I think. No?

Let’s say the full value of the Nobel Prize (V) is a weighted sum of its partial values (v_i), i.e., the money award that one normally hears about, the medal value, the diploma value, and whatever net positive externalities there may be. Briefly

$$V = \sum_i^n a_i v_i, \quad \sum a_i = 1, \quad (1)$$

where the cardinal weights a_i are unknown, but ordinally people tend to put more weight on the money value of the award than on the other components. Again the objective of this exercise it to try to change that.

3.2 Value of Nobel Prize Medal (v_2)

⁶An Erdos number is a number representing the “degree of collaborative distance” between mathematician Paul Erdos, his co-authors, and their authors, with the number zero for Erdos himself.

Let us designate v_2 as the partial value of the Nobel Prize medal. We can estimate v_2 from the market price of gold (P). We know that prior to 1980 Nobel Prize winners received a 23-karat gold medal 66 mm in diameter and weighing 200g. Since 1981 winners have been given an 18-karat green gold medal of the same dimensions and weight as in previous year, but plated with 24-karat gold. The medal was designed by the famous Swedish multi-media artist Gunvor Svensson-Lundkvist (also spelled Lundqvist). Thus, v_2 is some linear combination of the value of the gold medal (PQ) and a constant G representing the designer premium (added value), i.e.,

where P is the average gold price of medal that year, which in 2009 equaled to \$8900 in 2009 dollars for years prior to 1980, and \$6900 for years after 1980; and Q is the number of Nobel Prize awards that year, equal to five until 1968 and six since 1969 with any number of winners sharing one prize in each category. Thus, assuming $Q = 1$ and $G = 0$, the value of the Nobel Prize in 1901 in 2009 SEK was

$$v_2 = PQ + G, \quad (2)$$

$$V_{1901} = v_{1;1901} + [PQ_{1901} * \eta_{1901}] = 7872648 + \$8900 * 6.6520166 = 7872648 + 59202.95 = 7931850.90 \text{ SEK}. \quad (3)$$

Similarly, in 1998,

$$V_{1998} = v_{1;1998} + [PQ_{1998} * \eta_{1998}] = 8926244 + \$6900 * 8.07156 = 8926244 + 55693.76 = 8981937.70 \text{ SEK}, \quad (3')$$

where η is the US\$-Kronor rate of exchange. Then, across Nobel Prize categories we multiple V_{1901} by 5 categories and winners, and V_{1998} by 6 categories and winners. In 2010 for example there were six categories but 11 winners (1 in Physiology/Medicine, 2 Physics, 3 Chemistry, 1 Literature, 1 Peace, and 3 Economics).

More likely than not, $G > 0$, representing the value added (premium) to the medal by its designer and engraver. One expects a medal value to rise (fall) with the popularity (infamy) of its maker. In this specific case G can be approximated by the average value of a Gunvor Svensson-Lundkvist piece of art. This value is unknown, but it does exist. Since there is no straightforward way to estimate G, I use some commonsensical proxies gleaned from relevant history. For example, I found that in the 1960s Svensson-Lundkvist did a *Dag Hammarskjold* (Second UN Secretary General) *commemorative medal*. The value of that medal can be used to represent G for the 1960-1980 period. Another significant art piece by Svensson-Lundkvist is “Amanda” from her “Women in Myth and Reality” collection, which can be used to proxy G for the 1970s-1990s. For the 1990-2000 period I considered Svensson-Lundkvist’s “Circus” exhibit, but was unable to find reliable prices. Theoretically these

overlapping Gs give the average G in (2) above.

The search for a G as envisioned above turned out more difficult than anticipated mainly because it requires much time and effort, and better understanding of the operations of auctions, auctions markets, and the pricing of art pieces than I have. The prices of these pieces have differed greatly, and I could only find prices for Svensson-Lundkvist's replica pieces like the Dag Hammarskjold commemorative medal in bronze token selling for \$40 and in bronze coin going for \$49. Twice, in 1978 and 1990, her 56mm 121.92g silver medal sold for 300 SEK, and in 1992 a 59mm 101.2g sterling silver medal of King Karl Gustaf XVI sold for 500 SEK. From this limited data, it would seem the average G = 362.5 SEK, i.e., Svensson-Lundkvist design adds 362.5 SEK to the value of the Nobel Prize medal. Thus, adjusted for G (2) is

$$v_{2;1901}=(PQ)_{1901}+G=59202.95+362.5=59565.45\Rightarrow V_{1901}=v_{1;1901}+v_{2;1901}=7932213 \text{ SEK.} \quad (4)$$

However, V and v_2 in (4) are still incomplete since G is likely adjusted upward or downward by a *coefficient of influence*. It is known, for example, that Svensson-Lundkvist's work was *influenced* by the Russian sculptor Michael Katz in the 1930s, by her husband Bengt Inge Lundqvist, and by her own (family's) travels to Florence, Rome, Amsterdam, Brussels, London, and Paris in the 1940s-1950s, so that (2) or (4) becomes

$$v_2=PQ+\theta G, \quad (5)$$

where θ is the coefficient of influence of others on Svensson-Lundkvist's design of the Nobel Prize medal, for $\theta = 1$ in (2) and (4). Since from (5) $\theta = [(v_2 - PQ)/G] + e$, we can set $\theta = (\$200\eta)$, where \$200 is the value of Michael Katz's abstract painting "Jediah '17". In that case, (5) becomes

$$v_2=59202.95+[(\$200\eta)(362.5)] \text{ SEK,} \quad (5')$$

where [] term is interactive θG . And finally

which is still not full, because it does not reflect the value of the Nobel Prize diploma (v_3), discussed next below.

$$V=v_1+PQ+\theta G=v_1+v_2, \quad (6)$$

3.3 Value of Nobel Prize Diploma (v_3)

The value of the Nobel Prize diploma (v_3) is even harder to calculate than the value of the Nobel Prize medal, but that alone is no reason not to try. We know for certain that v_3 is at least the same value as the highest college diploma the winner already has; most winners do not forego “much” to get a Nobel Prize, many already being senior professionals in their chosen fields, and in a few cases even retirees.⁷ For that the opportunity cost is low; there are very few, if any, scientists who deliberately seek to earn a Nobel Prize. Given controversies about deserving people who have not won, and presumably undeserving people who have won, a Nobel Prize diploma is not an economical pursuit. Yet it clearly adds considerable marginal benefit to the winner’s value.

Winning a Nobel Prize raises the stock value of the winner by quite a bit – the so-called “Matthew effect” (Merton, 1968, Mazlounian, et. al., 2011). However, it is not so clear whether the rise is due to the Nobel Prize, or due to the fact that Nobel Prize winners earn more because they work even harder after winning the Prize. Here are my two personal stories of the value of a Nobel Prize winner. One, during my last two years as an undergraduate student at UCLA I got to know casually Professor Donald J. Cram. I visited with him frequently and his door was always open for me and his students (I was an economics student). Then in 1987 Dr. Cram won the Nobel Prize for his contributions to Chemistry, and hence to “mankind.” Only two weeks after he won, I stopped by his office hoping to say “congrats,” but understandably by then I was very low on a 6-month waiting list. The poor guy was working even longer hours off-campus than before, while somehow still maintaining his regular campus job.

The second personal story is that throughout my student years at UCLA I was actively engaged in student politics, especially on issues relating to the University of California’s investment in firms that did business with Apartheid South Africa and Namibia.⁸ In that capacity in 1984 I was one of the students who petitioned Chancellor Charles E. Young and the UCLA administration to pay Bishop Desmond Tutu of South Africa an honorarium when he came to speak on campus at our invitation. We met strong resistance at first, but finally succeeded and arranged for Tutu to speak in a UCLA Law School hall that sits approximately 1500. A number of South African students and I were responsible for finding the Tutus (the Bishop and his wife) accommodations, which went very well. However, on the day of the speech only 45 students showed up, and most in attendance were from Africa. We were both angry and embarrassed that the university administration may have been justified in their resistance to pay Tutu an honorarium.

Here is the turn of events. Two or three weeks later, while still in California on the same visit, Bishop Tutu won the Nobel Peace Prize. We felt proud and vindicated, and looked forward to his return visit to UCLA. When he came back, he spoke to a packed Pauley Pavilion (UCLA’s famed basketball hall). His guests-of-honor were mainly top African-American leaders like Rev Jesse Jackson, U.S. Rep. Maxine Waters, Mayor Tom Bradley, and so on. My girlfriend then (and wife now), many others, and

⁷The exception is the Nobel Peace Prize because many winners in this category have face life-threatening situations including long-term detentions and prosecutions.

⁸For an undergraduate student my published record on those topics is not bad at all, if I can pat myself on the back.

I watched the speech from a monitor outside the Pavillion. We had no tickets. When our group that had brought Bishop Tutu to campus only three weeks previous asked to see him and to congratulate him on being given a Nobel Peace Prize, we were told we could not see him for “security reasons.” What a difference a Nobel Prize made to the value of a person in three weeks!⁹

The point of my two stories is that while it is difficult to determine whether these people are worth more because they won the Nobel Prize (a return on past hard work) or because after winning the Nobel Prize they worked harder than before, we can be certain that the true value of a Nobel prize diploma is not zero. At the very minimum v_3 is the cost of (a) the material used to make the diploma, (b) the artist and calligrapher design and other time and effort (Designing), and (c) binding the diploma (Binding). Clearly (c) is a fixed cost, (b) is the opportunity cost of taking on the designing of a Nobel Prize diploma as opposed to doing the next best job, and (a) is a sticky variable cost, so that ,

$$v_3 = \lambda_1 \text{Materials} + \lambda_2 \text{Designing} + \lambda_3 \text{Binding}, \text{ where } \lambda_i = \text{average cost.} \quad (7)$$

The question is: What is λ , and hence v_3 ? According to the Nobel Prize website, three companies have been involved in binding Nobel Prize diplomas. In Sweden there is Falth & Hassler bookbindery (formerly Hassler Bokbinderi), and in Norway is Refsum until 1986, and Kjell-Roger Josefson since 1986. Table 6 below lists the artists and calligraphers responsible for designing Economics Nobel Prize diplomas over the years.

Table 6 - Artist and Calligraphers of Economics Nobel Prize Diplomas, 1969-2010

Year	Name
1969	Reinhold Ljunggren
1970-1971	Gunnar Brusewitz, Elsa Noreen
1972-1973	Gunnar Brusewitz
1974	Karl Axel Perhsson
1975-1976	Tage Hedqvist
1977-1980	Sven Ljungberg
1981-1987	Sven Ljungber, Sven Hoglund

⁹Then in 1993 I was at Heathrow International Airport and there was Bishop Tutu. He recognized me right away and we chatted briefly before both taking the same flight to Cape Town although he was in first class and I in couch. It felt good to meet him again, and to know that he understood my friends and I were no security threat to him or any one else.

Year	Name
1988-1989	Sven Ljungberg, Annika Rucker
1990-1993	Philip von Schantz, Annika Rucker
1994- 1998	Bengt Landin, Annika Rucker
1999-2003	Nils G. Stenqvist, Annika Rucker
2004	Jordi Arko, Annika Rucker
2005	Ulla Kraitz, Annika Rucker
2006	Ingegerd Moller, Annika Rucker
2007	Per Enoksson, Annika Rucker
2008	Jean-Louis Maurin, Annika Rucker
2009	Roland Jonsson, Annika Rucker
2010	Sture Berglund, Annika Rucker

Data Source: http://nobelprize.org/nobel_prizes/about/diplomas/chronological.html.

According to Birgitta Lemmel of Nobelprize.org, for example, the artist and calligrapher of Amartya Sen’s diploma, respectively, were Bengt Landin and Annika Rucker. The binder was Falth & Hasslers. Theoretically, by finding the values of some work of Falth & Hasslers and Landin and Rucker, we can estimate (7) above. But first, let’s pursue (7) piece by piece beginning with the Designing value in Table 7 below. Based on bits of information I found on the internet, it appears that on average the artist contributes \$593.58 to the full value of a Nobel prize diploma, however that contribution varies across artists. These are rough estimates based on the average auction values of pieces of art by individual artists in all media. Given that some artists like Philip von Schantz have sold more pieces than others, it is quite possible these estimates are biased upward, but the average seems reasonable (see <http://www.findartinfo.com/search/listprices.asp>).

Table 7 does not include the contributions of calligraphers to the value of the Nobel Prize diploma, making Annika Rucker’s statement correct that she is ‘like the shoe-maker, [for whom] everyone only admires the shoe, [and] no one asks about him’ (see e.g., <http://www.hindustantimes.com/StoryPage/Print/620132.aspx>). This is clearly a defect that needs rectified since in some cases, as in the case of Annika Rucker herself, artists work for the calligrapher.

Table 7 - Average Artist Contribution to Value of Economics Nobel Prize Diploma¹⁰

Nobel Year	Artist	Year Auction Occurred	Average Value, US \$	Number of Pieces, Medium
1969	Ljunggren	2004-2006	211.34	62, Multi
1970-1971	Brusewitz	2004-2009	480.27	165, multi
1972-1973	Brusewitz	2004-2009	480.27	165, multi
1974	Pehrsson*	N/A	390.63	N/A
1975-1976	Hedqvist	2004	477.61	55, multi
1977-1980	Ljungberg	2006-2010	534.69	112, multi
1981-1987	Ljungberg	2006-2010	534.69	112, multi
1988-1989	Ljungberg	2006-2010	534.69	112, multi
1990-1993	von Schantz	2002-2009	1275.69	375, multi
1994-1998	Landin	2004-2009	276.21	116, multi
1999-2003	Stenqvist	2006-2009	97.82	17, multi
2004	Arko	2004-2010	235.25	16, multi
2005	Kraitz*	N/A	475.30	N/A
2006	Moller	2007-2008	152.67	3, multi
2007	Enoksson	2008-2010	2935.67	6, multi
2008	Maurin	2008	21.00	1, lintograph
2009	Jonsson	2008	566	2, watercolor
2010	Berlund*	N/A	593.58	N/A

* No data was found, and so the value is the average of values before it; N/A = not available.

Data Source: Calculated from data collected at <http://www.findartinfo.com/search/listprices.asp>.

Ms. Rucker has been coordinating the fine art of Nobel Prizes since 1988, creating nearly 200 diplomas during that time period. From her own description of the process, one gathers that putting together the Nobel Prize diploma includes the cost of the goose-/swan-feather quill, cost of leather, cost of creating

¹⁰Excludes calligraphers, but artists are listed more than once when they have worked with different calligraphers in different years.

the winner's monogram, cost of researching the background and personality of the winner, cost of typography, as well as the cost of the actual calligraphy of the citation which "takes up to two days to complete one citation."¹¹ From examining various internet resources and emailing a few calligraphers in the USA, including one who claimed to have calligraphed diplomas for Columbia University, I estimate the average market price of a single diploma calligraphy to be about \$30, or \$60 minimum for the Nobel Prize diploma (http://www.thaindian.com/newsportal/uncategorized/heres-the-art-behind-nobel-citations_100452189.html).¹² The average cost of non-calligraphic elements of the Nobel Prize diploma appears to be 432 SEK,¹³ so that

$$v_3 = [432 + \eta(\$Calligraphy + \$Art)]SEK = 432 + \eta(\$60 + \$Art) SEK. \quad (7')$$

For 1969 $v_{3;1969} = 432 + \eta_{1969}[\$60 + \$Art_{1969}] SEK$, implying $V_{1969} = v_{1;1969} + v_{2;1969} + v_{3;1969} SEK$.

From all the above, (1) is thus

$$V = v_1 + v_2 + v_3. \quad (8)$$

This can be calculated for each year as

$$V_t = 432 + v_{1;t} + \eta_t[(PQ + \$200G) + (\$60 + \$Art)]_t SEK, \quad (8')$$

where again v_1 is what is normally reported as the Nobel Prize award, and v_2 and v_3 are medal and diploma values.

Table 8 - Components of the Value of the Economics Nobel Prize, 1969-2010

¹¹The color is decided by the Royal Swedish Academy of Sciences in the case of Economics and other disciplines.

¹²Even assuming one diploma takes two days to finish one diploma, this estimate is likely low because it disregards that each diploma is made special for the recipient.

¹³I assessed this average from pieces of data from the Art of the Nobel Prize available at www.Artnet.com, www.Artprice.com, and Lekskon Nobelovaca at Stockholm's www.Auktionsverk.se.

Nobel Year	η	PQ	G	v_2	Binding	Designing	v_3
1969	5.17	92026.00	119130.90	211156.9	310.20	1092.63	1402.83
1970	5.17	42013.00	59565.45	101578.45	310.20	2483.00	2793.2
1971	4.87	43298.50	59565.45	102863.95	291.90	2336.51	2628.41
1972	4.74	84425.40	119130.90	203556.3	284.58	2277.92	2562.5
1973	4.59	40828.75	55565.45	96394.2	275.25	2203.24	2478.49
1974	4.08	72632.90	119130.90	191763.8	244.83	1593.97	1838.8
1975	4.39	78061.90	119130.90	197192.8	263.13	2094.56	2357.69
1976	4.13	36725.85	59565.45	96291.3	247.59	1970.86	2218.45
1977	4.67	83571.00	119130.90	202701.9	280.17	2496.74	2776.91
1978	4.29	38229.95	59565.45	97795.4	257.73	2296.76	2554.49
1979	4.15	73807.70	119130.90	192938.6	248.79	2217.09	2465.88
1980	4.37	38917.92	59565.45	98483.37	262.3.7	2338.09	2600.39
1981	5.57	384399.00	59565.45	443964.45	334.26	2978.76	3313.02
1982	7.29	50332.05	59565.45	109897.5	437.67	3900.30	4337.97
1983	8.00	55206.90	59565.45	114772.35	480.06	4278.55	4758.61
1984	8.98	62027.55	59565.45	121593	539.37	4806.60	5345.97
1985	7.61	52546.95	59565.45	112112.4	456.93	4071.93	4528.86
1986	6.81	47051.10	59565.45	106616.55	409.14	3646.05	4055.19
1987	5.85	40351.20	59565.45	99916.65	350.88	3126.87	3477.75
1988	6.16	42483.30	59565.45	102048.75	369.42	3292.09	3661.51
1989	6.23	42966.30	59565.45	102531.75	373.62	3329.52	3703.14
1990	6.64	137344.50	178696.35	316040.85	398.10	8462.74	8860.84
1991	6.84	47189.10	59565.45	106754.55	410.34	8722.94	9133.28
1992	7.04	48596.70	59565.45	108162.15	422.58	8983.14	9405.72
1993	8.31	114615.90	119130.90	233746.8	498.33	10593.42	11091.75
1994	7.46	154453.05	178696.35	333149.4	447.69	2060.94	2508.63
1995	6.66	45941.58	59565.45	105507.03	400.92	1839.06	2239.98
1996	6.87	94819.80	119130.90	213950.7	412.26	1897.84	2310.1
1997	7.88	108702.60	119130.90	227833.5	472.62	2175.71	2648.33
1998	8.06	55620.90	59565.45	115186.35	483.66	2226.53	2710.19
1999	8.53	58822.50	59565.45	118387.95	511.50	833.92	1345.42
2000	9.54	131583.00	119130.90	250713.9	572.10	932.71	1504.81
2001	10.67	220817.25	178696.35	399513.6	640.05	1043.50	1683.55
2002	8.83	121785.00	119130.90	240915.9	529.50	863.26	1392.76

2003	7.19	99210.96	119130.90	218341.86	431.35	703.25	1134.6
2004	6.62	91281.48	119130.90	210412.38	399.69	1556.09	1955.78
2005	7.96	109825.92	119130.90	228956.82	477.04	3782.63	4259.67
2006	6.86	47364.36	59565.45	106929.81	411.86	1047.99	1459.85
2007	6.41	132761.52	178696.35	311457.87	384.82	18828.21	19213.03
2008	7.81	53893.14	59565.45	113458.59	468.64	164.02	632.66
2009	7.12	98207.70	119130.90	217338.6	426.99	4027.94	4454.93
2010	6.71	138890.79	178696.35	317587.14	402.58	3982.74	4385.32

η = SEK/US\$ exchange rate; PQ = value of the metal content of the medal; G = designer premium of medal; v_2 = partial medal value; Binding = cost of binding diploma; Designing = cost of designing diploma; and v_3 = partial value of diploma.

Data Source: Exchange rate data is from the World Bank's *International Financial Statistics Yearbooks* 1980, 1990, April 2011 - rounded to the nearest tenth. For other data see previous tables.

Table 9 - Adjusted Monetary Value of the Economics Nobel Prize in 2009 SEK – 1969-2010

Year	v_1	v_2	v_3	V
1969	2923643	2925612	5849255	11698510
1970	2920339	2922309	5842648	11685296
1971	3052559	3054530	6107089	12214178
1972	3074498	3076470	6150968	12301936
1973	3061777	3063750	6125527	12251054
1974	2998892	3000866	5999758	11999516
1975	3128213	3130188	6258401	12516802
1976	3071631	3073607	6145238	12290476
1977	2831221	2833198	5664419	11328838
1978	2663486	2665464	5328950	10657900
1979	2745817	2747796	5493613	10987226
1980	2655412	2657392	5312804	10625608
1981	2692188	2694169	5386357	10772714
1982	2851007	2852989	5703996	11407992

Year	v₁	v₂	v₃	V
1983	3414135	3416118	6830253	13660506
1984	3475389	3477373	6952762	13905524
1985	3532346	3534331	7066677	14133354
1986	3766120	3768106	7534226	15068452
1987	3928223	3930210	7858433	15716866
1988	4269078	4271066	8540144	17080288
1989	4817335	4819324	9636659	19273318
1990	5816034	5818024	11634058	23268116
1991	7970702	7972693	15943395	31886790
1992	8439714	8441706	16881420	33762840
1993	8311087	8313080	16624167	33248334
1994	8499648	8501642	17001290	34002580
1995	8526186	8528181	17054367	34108734
1996	8721067	8723063	17444130	34888260
1997	8796801	8798798	17595599	35191198
1998	8926244	8928242	17854486	35708972
1999	9234532	9236531	18471063	36942126
2000	10414372	10416372	20830744	41661488
2001	11298361	11300362	22598723	45197446
2002	11059050	11061052	22120102	44240204
2003	10850126	10852129	21702255	43404510
2004	10809285	10811289	21620574	43241148
2005	10762024	10764029	21526053	43052106
2006	10538226	10540232	21078458	42156916
2007	10183215	10185222	20368437	40736874
2008	10093732	10095740	20189472	40378944

Year	v₁	v₂	v₃	V
2009	10182428	10184437	20366865	40733730
2010	10271123	10273133	20544256	41088512

v_1 = partial money value of Nobel Prize; v_2 = partial medal value of Nobel prize; v_3 = partial diploma value of Nobel Prize; and $V = v_1 + v_2 + v_3$.

Table 10 - Actual versus Adjusted Monetary Value of the Economics Nobel Prize in 2009 SEK – 1969-2010 (Cum = cumulative)

Year	v₁	Cum v₁	V	Cum V
1969	2923643	2923643	5849255	265825382
1970	2920339	5843982	8766291	534567800
1971	3052559	8896541	11951071	806494998
1972	3074498	11971039	15047509	1081518634
1973	3061777	15032816	18096566	1356591327
1974	2998892	18031708	21032574	1637600028
1975	3128213	21159921	24290109	1921866264
1976	3071631	24231552	27305159	2209147550
1977	2831221	24512773	27345971	2498851913
1978	2663486	27176259	29841723	2791134359
1979	2745817	29922076	32669872	3086154549
1980	2655412	32577488	35234880	3383776543
1981	2692188	35269676	37963845	3684286281
1982	2851007	38120683	40973672	3988368994
1983	3414135	41534818	44950936	4296490325
1984	3475389	45010207	48487580	4608205257
1985	3532346	48542553	52076884	4923743267
1986	3766120	52308673	56076779	5243443275

Year	v₁	Cum v₁	V	Cum V
1987	3928223	56236896	60167106	5567574465
1988	4269078	60505974	64777040	5896863846
1989	4817335	65323309	70142633	6232515519
1990	5816034	71139343	76957367	6577136594
1991	7970702	79110045	87082738	6932352052
1992	8439714	87549759	95991465	7296347610
1993	8311087	95860846	104173926	7668714190
1994	8499648	104360494	112862136	8049795518
1995	8526186	112886680	121414861	8439624442
1996	8721067	121607747	130330810	8838445049
1997	8796801	130404548	139203346	9246267635
1998	8926244	139330792	148259034	9663454197
1999	9234532	148565324	157801855	10091363420
2000	10414372	158979696	169396068	10531750850
2001	11298361	170278057	181578419	10984081310
2002	11059050	181337107	192398159	11447022590
2003	10850126	191218723	202070852	11920564230
2004	10809285	202996518	213807807	12404827060
2005	10762024	213758542	224522571	12899580850
2006	10538226	224296768	234837000	13404294070
2007	10183215	234479983	244665205	13918746000
2008	10093732	244573715	254669455	14443290880
2009	10182428	254756143	264940580	14978195580
2010	10271123	265027266	275300399	15517386740

Data Source: See previous tables.

Table 8 displays basic data on the components of (8) before calculating it. Again it is assumed that $P = \$8900$ before 1980, and $\$6900$ since 1980. From Svensson-Lundkvist's biography, it is clear that she was influenced by the Russian sculptor Michael Katz. I could only find one piece of Katz's work the so-called "Jidiah" selling for $\$200$. However, because $\theta = \$200$ appears to have an exaggerated effect on the value of a diploma, I abandoned it. In all that follows $\theta = 1$. Noticeable in this table is that v_2 is not insignificant; the value of the metal content of the medal (PQ) may or may not be inflated as the actual P has varied over the years (Newcomb and Tsuji, 1990). Even with $\theta = 1$, G adds significant value to v_2 so that the Nobel Prize medal can be predicted to fetch 317,587.14 SEK (US\$47,330.42 at the 2010 official SEK/US\$ rate of exchange). At the same exchange rate, the Nobel Prize diploma would sell for US\$653.55. Thus, the full value of the Nobel Prize (V) in all its components is presented in Table 9; there is a huge difference between v_1 and V . For example, in 1987 Robert Solow received 3.93 million SEK (US\$671,491.11) for his award. Considering the values of the medal and diploma, his full Prize was 15.72 million SEK or US\$2.69 million.

Finally Table 10 presents the full value of the Economics Nobel Prize in 2009 SEK monetary value. Compared to previous tables, the differences are huge, because while v_1 is unchanged, v_2 and v_3 changed with P , Q , G , and Binding and Designing costs. In other words, there is only one v_1 shared equally among however many winners, but each winner receives a separate medal, and a separate and distinct diploma.

4. Value of Nobel Prize: Tentative Propositions and Their Implications for Human Capital Accumulation, Technological Change, and Long-Run Economic Performance

The data described above clearly shows that Alfred Nobel and his Foundation have kept their end of the promise; they backed it up with real money - big money. Now the question is: What is the cumulative impact of the Nobel Prize on "mankind"? A separate part, Part 2, of this exercise will seek to contribute to the answer to that question. Here I only sketch general relationships (a) between the Nobel Prize and human capital building, (b) between human capital and technological change, and (c) between technological change and human capital on the one hand and long-run economic growth on the other.

At the general level the propositions Part 2 will make do not require a brand new economic theory. Since the intention of the Nobel Prize is to support welfare enhancing activities, both conventional production and welfare economic theories are well-equipped to deal with that despite disagreements among economists about normative economics, especially the specifications of social welfare functions. Even with that discord, at its Annual Meeting in Denver, Colorado (January 7-9, 2011), the American Economic Association sanctioned a session on "Economics as a Moral Science." The papers in that session aimed at (a) renewing interest in welfare economics (Tony Atkinson), (b) characterizing the (im)morality of markets (J. Bhagwat), (c) describing the moral and religious origins of economics (Ben Friedman), and (d) outlining a worldly philosophy of economics (Shiller and Shiller). These calls are re-energizing, but not new as Edmund S. Phelps (1969) and his very famous coauthors illustrate in *The Goal of Economic Growth*.

Moreover, even without a generally accepted social welfare function, Lee Davis and Jerome Davis (2004) were able to study the implications of prizes as incentives for the "industrial dynamics, innovation, and

development” observed during the 20th Century, such as “motorized flight, human powered flight, and energy efficient refrigerators”. They find that prizes motivate inventive/innovative activities, but the structures of the spillover and reputation effects they engender are still difficult to unravel, and thus the authors conclude that “prizes have important positive externalities for the sponsors” rather than for the winners and society in general. This is not hard to understand as sponsors must raise the needed funds.

The approach I take in Part 2, however, is simple. It starts with a maintained assumption that unknown future (Nobel) prize winners today ($t=0$) pursue their self-interests, expecting no grand pay-off (prize) for their efforts. Thus collectively they maximize the sum of their discounted utilities from their activities (z, t) subject to their budget ($y(z, t)$), i.e.,

$$\text{Max} \int_0^T \int_1^Z U(z,t) + \lambda y(z,t) dz dt; \text{ s.t. } y(z,t) > 0, t = 0, 1, 2, \dots, T \Rightarrow \text{discounting}; z = 1, 2, 3, \dots, Z; t \neq z. \quad (9)$$

In the “ordinary business of life” $U(z, t)$ has some significant social value, but it becomes a driving force upon winning a (Nobel) prize, such that social welfare comes to depend on the welfare of prize winners, which can be stated as the following maxmax:

$$W = \max [\max \int_0^T \int_1^Z U(Z,t) + \lambda y^*(Z,t) dz dt]; \text{ s.t. } y^*(Z,t) > 0, \quad (10)$$

where y^* is prize-influenced budget. In other words, (10) implies society has the same, but not identical, preferences for a typical Nobel Prize winner, differing only in that the full Nobel Prize award is now an argument in the social budget control (Sterdy, 1960). I demonstrate (10) more precisely later. For now the following propositions will characterize Part 2.

4.1 Economic Activity and Human Development

First, a key proposition is that an economic activity like the production of real GDP (Y) ultimately depends on the economy’s technical capability

$$e^{\int x dt = HDI} \quad (11)$$

where $x = HDI = H^a Y^b$ is the human development index (HDI), for H = human capital index of the population, Y = the material conditions of the population, and $a = 2/3$ and $b = 1/3$ are weights.

4.2 Human Development and Human Capital Accumulation

For $x=H^a Y^b$, it follows that

$$Y=(x \cdot H^{-a})^{1/b}. \quad (12)$$

Now we can think of net $x=f(N,K)$ as Romer's object production function, then (12) becomes

$$Y=(f(N,K) \cdot H^{-a})^{1/b}. \quad (13)$$

. Assuming f is Cobb-Douglas, (13) can be restated as the Lucas's "miracle" model

$$Y=[(N^c K^d) H^{-a}]^{1/b}=[(N^{c/b} K^{d/b}) H^{-a/b}] = N^\alpha K^\beta H^\gamma, \quad (14)$$

where $\alpha=c/b$, $\beta=d/b$, $-a/b=1-\alpha-\beta=\gamma$ are parameters.

4.3 Human Capital, Technological Change, and Nobel and Other Prizes

Conventionally, from (13)

$$H=(Y N^{-\alpha} K^{-\beta})^{1/\gamma}. \quad (15)$$

However, (15) suggests that H is just a residual and therefore a part of A in the Hicks-Solow neutrality sense. To avoid sending that message, I modify Lucas to Romer by posing that¹⁴

$$H=A e^{\int \phi q} N, \quad (16)$$

such that

$$Y=N^\alpha K^\beta [A e^{\int \phi q} N]^\gamma. \quad (17)$$

¹⁴The reason for indefinite integration is to suggest that q is a 3-dimensional matrix of which quality is one dimension, quantity is another, and time is yet another dimension. In this sense H is 3D, not an area under the curve.

Thus, for $H=e^{\int \phi q} N$, $Y=AN^\alpha K^\beta H^\gamma \Leftrightarrow Y=H_Y^\alpha L^\beta A_p$, in which $A_i = \int_0^A X(i)^\gamma$, $\gamma=1-\alpha-\beta$. Thus, (17)

$$Y=N^\alpha K^\beta \left[\int_0^A X(i) e^{\int \phi q} N \right]^\gamma. \quad (18)$$

Whereas it is precise, (18), especially its $\int_0^A X(i)^\gamma dA$ term, is too data demanding. Following Amavilah (1996), and Amavilah and Newcomb (2004), I argue that A is both Arrow-learning to capture technological change (invention, innovation, and diffusion) and Hicks neutral (or even Solow neutral if one this of H and K as just total K) to reflect technical progress (cf. Solow, 1997). Hence A evolves as

$$A=A_0 e^{\mu\tau+\delta t}, \quad (19)$$

where τ is a learning function of cumulative Y in response to inputs, especially H. For $\tau=\phi \bar{Y}^\xi$,

$$\dot{A}=A_0 \mu \phi \bar{Y}^{\xi+\delta t} \Rightarrow \dot{A}=\mu \phi \xi \bar{Y}^{\xi-1} N^\alpha K^\beta \left[\int_0^A X(i) e^{\int \phi q} N \right]^\gamma + \delta. \quad (20)$$

In terms of growth rates, the first term of (20) represents technological change made possible by learning and the second term measures the exogenous rate of technical change. Plugging (20) into (17) gives us

$$Y=N^\alpha K^\beta [A_0 e^{\mu\theta \bar{Y}^\xi + \delta t} e^{\int \phi q} N]^\gamma, \quad (21)$$

and I expand on (21) in Part 2 of this exercise.

4.4 Economic growth, Human Capital, Technological Change, Nobel and other Prizes

Dividing (20) by N and rearranging, per capita Y becomes

$$y=k^\beta [A_0 e^{\gamma_1^* + \gamma_2^* t + \int \gamma_3^* q}], \quad (22)$$

where $y = Y/N$, $k = K/N$, and $\gamma_1^* = \gamma\mu\theta\bar{Y}^\xi$, $\gamma_2^* = \gamma\delta$, $\gamma_3^* = \gamma\phi$. Because (22) gets rid of the double integrals, it minimizes somewhat “the perils of the learning model for modeling endogenous technological change” that Nordhaus (2009) describes. The Nobel Prize variable can enter (22) either as an argument of A, or an element of H, and included in q . As an argument of A, it implies that technological change is Arrow-learning with a Hicks neutral rate of technical change. As an element of H, technological change is Arrow-learning with a Harrod rate of technical change. Eq. (21) is Arrow-learning with Solow neutrality if we rewrite (18) as $Y = N^\alpha [A_0 e^{\mu\theta\bar{Y}^\xi + \delta t} K]^\beta e^{\int \gamma\phi q} N^\gamma$ (cf. Solow, 1997, Chapter 1; Hsiao, 1968).

Theoretically we can estimate (22) as

$$\ln y = a_0 + \beta \ln k + \gamma_2^* t + \int \gamma_3^* q, \text{ for } a_0 = \ln A + \gamma_1^*. \quad (23)$$

Practically, however, q is both cumulative and a function of time. That means that all the propositions stated above are tentative and untested. Part 2 of this exercise will first seek a deeper understanding of these propositions and their links to selected literature. Second, it will provide some, if only indicative, quantification of the insights gained.

5. Concluding Remark

The Nobel Prize ranks high among prestigious awards internationally. In its academic categories of Chemistry, Economics, Literature, Medicine/Physiology, and Physics, the Nobel Prize is arguably the highest honor any scholar can receive. It confers honor, advances research in the area, attracts research money, and raises the personal stock of the winner, thereby generating the “Matthew effect,” among many of its benefits. However, since the prize is given for significant contributions to humanity, it is not unreasonable to ask what its cumulative impact has been to-date. In that regard, there remains a gap in our understanding of this question, in large part because of the incompleteness of the data on the full value of the Nobel Prize.

This exercise seeks to fill in two cracks in the existing gap, and it does so in two related installments - Part 1 and Part 2. Part 1 - the current part - is a theory-less arithmetic exercise that calculates the full value of the Nobel Prize, including the values of the Nobel Prize medal and diploma. While it is a cheap “data” mining “without theory,” it is not a useless activity. For example, the exercise finds that Alfred Nobel and his people have kept their promise, and backed it up with real money - big money. On a per capita basis and over its life-cycle todate, the Nobel Prize exceeds many countries’ educational budgets, even without considering its time value of money. Impressive!

However, with such an impressive record the Nobel Prize raises questions about what its cumulative effect is. Part 1 sketches some fundamental relationships between human technical capability (development), human capital, technological change, the Nobel Prize, and long-run economic performance. Part 2 attempts to formalize the sketches of Part 1, seeking to understand their deeper theoretical and empirical content as well as interconnectedness. Thus, although Part 1 is not a research project in the Scientific

Method sense, the data, information, and insights it generates can be used to assess the implications of the Nobel Prize for human capital accumulation, technological change, and human development and economic performance. This is a letter of invitation to all interested parties to put this data to good use.

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