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UNDERSTANDING DIAMOND PRICING USING UNCONDITIONAL QUANTILE REGRESSIONS

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ABSTRACT

This paper investigates the relationship between the selling price of diamonds and their weight in carats. For this purpose, we use a unique sample of 112,080 certified diamonds collected from www.info-diamond.com during the first week of July 2011. We find substantial differences in pricing depending on cut shape. The price of diamonds increases markedly with the carat weight, with a price elasticity equal to 1.94. However, estimates from unconditional quantile regressions show that the price-weight elasticity is not constant since it rises along the price distribution of diamonds. Finally, we observe the existence of significant increases in prices for diamonds featured with round weights compared to gems just below these threshold weights.

Keywords: Diamonds, Discontinuity in price, Hedonic equation, Unconditional quantile regressions.

Code JEL: A1, D4

INTRODUCTION

When demand for a good durably exceeds its supply, economists expect a price increase of that good. The increasing trend should persist or even become more marked as long as no valid substitute appears on the corresponding market, as demand increases and as supply remains either constant or decreases. The diamond market is typical of such a situation. In 2003, world demand for rough diamonds (US$9.5 billion) was significantly above the diamond supply (US$8.2 billion), so that the excess demand had to be satisfied from producers' existing stockpiles. To absorb the difference between quantities supplied and demanded, a significant increase in exploration should occur to meet the increasing demand for diamonds. However, such a pattern does not seem possible because of technical difficulties.[1]

To explain the growing demand for diamonds over the last decades, Scott and Yelowitz (2010) stress that consumption of these durable goods is not only related to satisfaction provided by their intrinsic characteristics Lancaster (1971), but also to the social aspect that consumption of diamonds implies, namely conspicuous consumption (Veblen, 1899). In other words, it is likely that diamonds are bought for the impression their consumption makes on others, and they are purchased because they are expensive (Braun and Hotter, 2010). As a consequence, diamonds are likely to be bought at prices much above producers' marginal costs.

In the field of international economics, diamonds are classified as homogeneous goods (Rauch, 1999; Javorcik and Narciso, 2008).[2] This is a somewhat striking feature as there are plenty of objective characteristics like cut shape, weight, color, clarity, certification, polish, symmetry and fluorescence that are expected to have a strong influence on the diamond price. Hence, diamonds sound much more like a differentiated product. Curiously, despite the high value of the diamond market, we are aware of only one study so far that has attempted to assess the determinants of diamonds pricing. Drawing on a hedonic analysis of price à la Rosen (1974), Scott and Yelowitz (2010) investigate the impact of diamonds' characteristics on their price.

In their insightful contribution, Scott and Yelowitz (2010) reach a surprising conclusion. They show that buyers would be willing to pay premiums upward of 18% for a diamond that is one-half carat rather than buy a slightly less than one-half carat diamond and between 5% and 10% more for a one-carat diamond rather than buy a slightly less than one-carat diamond. These variations, analyzed from the classical economic viewpoint as pricing anomalies by the authors, may be explained by a whole-number effect. In other words, consumers would perceive a categorical difference between diamonds smaller than a carat and one carat or larger. Of course, there are other plausible explanations. Consumers could rely on rule-of-thumb decision rules, thereby introducing an artificial jump in demand at 1.0 carat; or diamonds considered as a durable good could be purchased for speculation.

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[1] For an overall description of the diamonds market, see for instance http://www.safariminerals.com/en/overall-market.html or http://www.diamineexplorations.com/web/index.php?id=147. It is estimated that approximately 80% of the world's annual production of rough diamonds is under the control of the De Beers Group and other major diamond producers including Rio Tinto Group, BHP Billiton Group and Alrosa Group. Antwerp is the world's largest diamond trading center with other key centers including Mumbai, Johannesburg and Tel Aviv.

[2] Following Rauch, J.E., 1999. , differentiated products are goods not having a reference price or goods whose price is not quoted on organized exchanges.

In this paper, we further document the price setting of diamonds using a unique database comprising more than 100,000 certified diamonds. Detailed information on diamonds was collected by the authors in July 2011 from the website www.info-diamond.com. We focus especially on the relationship between the price of a diamond and its weight in carat net of the role played by the other characteristics of the gems. Specifically, we estimate hedonic price equations and attempt to address the three following issues. Firstly, what is the contribution of the carat weight and other features when explaining price variation in diamonds? Secondly, is price-weight elasticity constant for low and high price levels, or does it vary along the price distribution? Thirdly, are there any jumps in price when nearing round weights? We rely on a hedonic price framework to bring answers to these questions. We find substantial differences in pricing depending on cut shape. The price of diamonds increases markedly with the carat weight, with a price elasticity equal to 1.94. However, estimates from unconditional quantile regressions following Firpo *et al*. (2009) show that price-weight elasticity is not constant since it rises along the price distribution of diamonds. Moreover, like Scott and Yelowitz (2010), we observe the existence of significant increases in prices for diamonds featured with round weights compared to gems just below these threshold weights. The remainder of the paper is organized as follows. In Section 2, we describe our online-collected data on diamonds. We estimate hedonic equations of diamond price in Section 3. Using unconditional quantile regressions, we investigate whether price elasticity remains constant along the price distribution in Section 4. The presence of discontinuity in prices at round weights is examined in Section 5. Finally, concluding comments are placed in Section 6.

DATA AND DESCRIPTIVE STATISTICS

We study the determinant of diamond prices using a unique data set collected by the authors during the first week of July 2011. Data are available online and come from the website *www.info-diamond.com*, defined as "*The universe of diamond, from the mine to the jeweller's*"; the corresponding information is thus publicly available. This website includes a diamond exchange service that enables every visitor to buy a certified diamond directly from the world's largest diamond merchants. For the sake of transparency, *Info Diamond* claims that they do not own all these diamonds, but they have permission from their diamond merchant partners to display their stock on their website. It follows that *Info Diamond* offers access to one of the largest diamond exchanges on the internet.[3] We construct a database comprising exactly 112,080 certified diamonds after deleting seven observations.[4] For each stone, the *Info Diamond* website provides very detailed

[3] Scott, F. and A. Yelowitz, 2010. also consider online data. They consider the online inventory of Blue Nile, Union and Amazon respectively and collected their data from July 6 to July 8, 2005.

[4] From our original sample of 112,087 diamonds, we chose to delete three diamonds with missing information on cut shape, two Flanders cut diamonds as there were only 2 diamonds with this particular cut shape, and the two most expensive diamonds (whose price was above 2 million euros) as they sound more like outliers.

characteristics of the product on a specific webpage. In Table 1, we present some descriptive statistics of the most important features of the diamonds.

Table-1. Descriptive statistics of the sample

Variables		Mean	St. dev.
Cut shape	Asscher	0.017	0.130
	Brilliant round	0.568	0.495
	Heart	0.015	0.121
	Cushion	0.077	0.266
	Marquise	0.027	0.162
	Oval	0.026	0.159
	Pear	0.042	0.201
	Princess	0.132	0.338
	Radiant	0.043	0.203
	Triangular	0.003	0.053
	Emerald	0.050	0.217
Weight (in carats)		1.159	0.862
Colour	Exceptional white + (D)	0.119	0.324
	Exceptional white (E)	0.163	0.370
	Rare white + (F)	0.174	0.379
	Rare white (G)	0.174	0.379
	White (H)	0.137	0.344
	Slightly tinted white (I-J)	0.164	0.370
	Tinted white (K-L)	0.052	0.222
	Tinted color (M-Z)	0.017	0.128
Clarity	Flawless - Internally Flawless (FL - IFL)	0.042	0.201
	Very Very Slightly Included (VVS1)	0.078	0.268
	Very Very Slightly Included (VVS2)	0.101	0.302
	Very Slightly Included (VS1)	0.182	0.386
	Very Slightly Included (VS2)	0.187	0.390
	Slightly Included (S1)	0.197	0.398
	Slightly Included (S2)	0.162	0.369
	Slightly Included (S3)	0.016	0.127
	Included (I1-I3)	0.034	0.181
Certificate	Gemological Institute of America (GIA)	0.732	0.443
	European Gemological Laboratory (EGL)	0.208	0.406
	Other laboratories	0.060	0.238
Polish	Excellent	0.425	0.494
	Very good	0.374	0.484
	Good	0.153	0.360
	Fair - Poor	0.048	0.214
Symmetry	Excellent	0.293	0.455
	Very good	0.399	0.490
	Good	0.235	0.424
	Fair - Poor	0.073	0.261
Fluorescence	None	0.758	0.428
	Faint	0.125	0.331
	Medium	0.078	0.269
	Strong - very strong	0.038	0.191
Number of observations		112,080	

Source: Authors' calculations using data from *Info Diamond*.

The first step in choosing a diamond involves selecting a shape, which is one of the only factors in diamond grading that is controlled by human hands. Cut shapes include Asscher, Round Brilliant, Cushion, Emerald, Flanders Heart, Marquise, Oval, Pear, Princess, Radiant and Triangular (see Figure 1 for a description). The Round Brilliant shape is the most popular one and is the most readily available in various qualities and sizes. The Princess shape is also becoming popular because it is both brilliant and unique. In our sample, the Brilliant and Princess are the most frequently observed shapes, with respectively 56.9% and 13.2% of stones. As emphasized by experts, the various shapes have an inherent difference in terms of the physics of light. Longer shapes like Pear, Oval, Marquise or Heart have a small zone in the center where light leaks out through the bottom, creating a darker area in the shape of a bow tie.[5]

Figure-1. Shapes of diamond

Source: Pictures from *Info Diamond* (www.info-diamond.com).

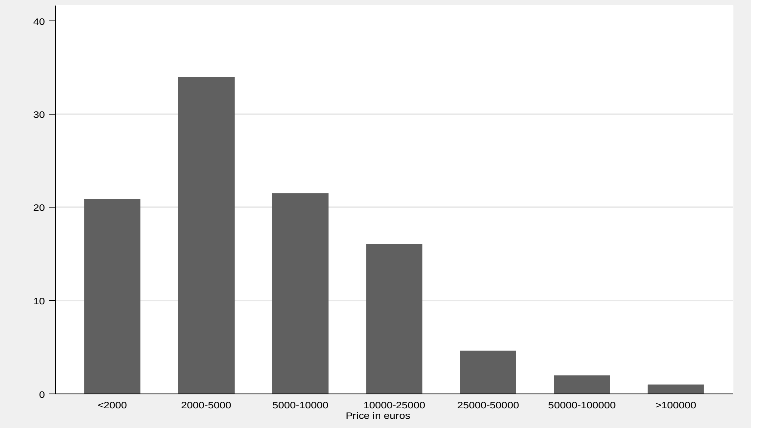
The unit of weight for a diamond is the metric carat. One carat corresponds to 0.2 gram. In almost all diamond-trading countries, it should be noted that the diamond's weight can only be rounded up to the next hundredth from nine thousandths of a carat. When turning to the *Info Diamond* data, we find that the average weight of the diamonds for sale is equal to 1.16 carats, with a standard

[5] See, for instance, advice from Robert Hensley, President of Diamond Helpers (http://www.diamondhelpers.com/ask/0026-cutshape.shtml).

deviation of 0.86. This means there is substantial heterogeneity in the size of the diamonds. The median weight is equal to 1 carat. The 90th and 99th percentiles are respectively equal to 2.02 and 5.01 carats and only 68 diamonds (0.06% of the sample) are above 10 carats. The color of a diamond is determined by using a certified set of master stones and a colorimeter, a device specifically designed to grade the color of a polished diamond. Colors range from letters D (the best grade) to Z (the worst grade). Categories D (exceptional white +) and E (exceptional white) are diamonds that disappear almost in the ultra white pre-folded cards. A light tint is perceptible on the side with F (rare white +) and G (rare white). H (white) occurs when a tint is perceptible, but difficult to see in front view. A tint is visible in front view for I and J (slightly tinted white), easily visible for K and L (tinted white), and readily visible in front view for colors ranging from M to Z. In our data set, most of the selected diamonds belong to the upper color category: 28.2% are exceptional white (D-E), 34.8% rare white (F-G), 13.7% white (H), 16.4% slightly tinted white (I-J), and 6.9% tinted white or tinted color (K-Z).

Another feature of the diamond is its clarity. The clarity scale includes 12 grades, ranging from FL (best grade) to I3 (worst grade). The FL grade (Flawless) is for diamonds having no imperfections either inside or outside under the magnification of a 10-power loupe. Stones classified IF (Internally Flawless) have no inclusions under a loupe. VVS1 and VVS2 (Very Very Slightly Included) concern stones having very small inclusions which are difficult to see under a loupe. Stones having small inclusions, which are slightly difficult to see under a loupe, are VS1 or VS2 (Very Slightly Included). SI1, SI2 and SI3 (Slightly Included) are stones with inclusions fairly easy to see under a loupe or even visible to the naked eye. Finally, I1, I2 and I3 (Included) are diamonds having flaws visible to the naked that may decrease the brilliance. In our sample, 4.2% of diamonds have no visible inclusion (FL-IFLS) and 17.9% have very small inclusions which are difficult to see (VVS1-VVS2). A certificate delivered by a gemological laboratory describes each diamond. This is a grading report that describes objective factors defining each stone, such as weight, clarity, color or measurement, among others. Any defect of the stone’s structure is noted on the certificate. In other words, such a certificate provides qualitative information. The most important gemological laboratories in the world are respectively the Gemological Institute of America (GIA), the European Gemological Laboratory (EGL), the American Gem Society (AGS), the International Gemological Institute (IGI) and the Hoge Raad voor Diamant (HRD). Among the diamonds for sale in our data, 73.2% have a GIA certificate and 20.8% an EGL certificate. Polish and symmetry shed light on the finish of a diamond. The polish result depends on the presence of more or less polish lines and the presence of strips, while the symmetry outcome corresponds to good alignment of the facets, their symmetry and the centering of both the culet and the table. Both outcomes are rated on a scale of five: excellent, very good, good, fair, and poor. We aggregate the two lowest categories, as there are very few diamonds with the poor grades. About 80% of diamonds have either an excellent or very good polish result, and 70% excellent or very good symmetry. Fluorescence characterizes diamonds that produce a visible reaction when they are exposed to ultraviolet radiation. Fluorescence is described using one of the following values: none, faint, medium, strong, very strong. Diamonds with a strong or very strong fluorescence are expected to be cheaper on average.[6] In our database, 75.8% of diamonds have no fluorescence and 12.5% faint fluorescence. The last three variables (not reported in Table 1) are related to the ideal cut of a diamond. The depth percentage of a round diamond is calculated by taking the total diameter of the diamond and dividing it by its total depth or height.[7] The table on a diamond corresponds to the flat facet on the top of the stone. Expressed as a percentage, it is defined by the total diameter of the diamond divided by its table width. For round diamonds, the range that is considered as ideal should fall between 55% and 58%.[8] Finally, there are several gradations of the culet size: no culet (preferable), pointed, very small, small, medium, large, very large and extremely large. All these objective characteristics are expected to influence or even make the price of diamonds. In our database, the mean price of a diamond (whatever its weight) is 10,230 euros, with a standard deviation of 25,880 euros. The median price is 4,440 euros. The cheapest diamond is sold for 465 euros and the most expensive one for 1,841,303 euros. As shown in Figure 2, there is a large dispersion in diamond prices: 20.9% of diamonds cost less than 2,000 euros, 34% cost between 2,000 and 5,000 euros. In the upper part of the price distribution, 4.6% cost between 25,000 and 50,000 euros, 2.0% between 50,000 and 100,000 euros, and 1% of diamonds cost more than 100,000 euros.

Figure-2. Distribution of diamond prices



Source: Authors' calculations using data from *Info Diamond*.

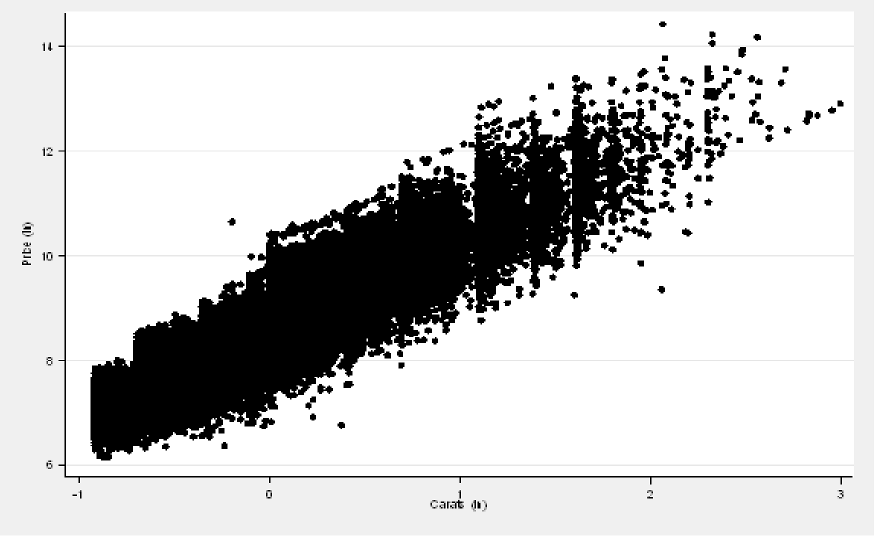
[6] According to *Info Diamond*, a slight fluorescence should depreciate diamonds D, E, and F, while it should give an increase in value to diamonds equal or below G.

[7] A depth too high or too low is likely to impact how a diamond reflects light. Ideal round diamonds should have a depth of between 59% and 62.5%.

[8] Both for depth and table, the range considered the best for round diamonds may slightly differ from company to company.

We now focus on the relationship between the diamond's price and its weight measured in carats. We plot the quantity of carats (in log) supplied at different price levels (in log) in Figure 3. An upward-sloping curve is expected as larger stones are much more rare than smaller ones. Our results provide strong support for a positive slope of the diamond supply curve. Interestingly, we observe from the scatter diagram that the various price-weight points are grouped into a clear linear shape. This means that the carat weight is a very strong predictor of diamond price. Estimation of a simple OLS regression expressing the log price as a function of the log carat weight leads to a price elasticity of 1.697, with a t-test of 736.24. The global fit of the linear model is very good as 82.9% of variability in diamond prices is attributed to variability in carats.

Figure-3. The diamond price-weight relationship



Source: Authors' calculations using data from *Info Diamond*.

Of course, these preliminary findings have to be cautiously interpreted as they do not take into account the role of the other observable features of the diamonds, including cut shape, color and clarity. In what follows, we turn to a more rigorous econometric framework and estimate hedonic diamond price functions.

A HEDONIC DIAMOND PRICE FUNCTION

To study the impact of the diamond's characteristics on its price, we first estimate a hedonic price equation using Ordinary Least Squares. This means that we focus on the average price of a diamond available in our database. Denoting by P_i the price of a diamond i, the model we seek to estimate may be expressed as:

$$\ln P_i = \alpha + \delta * \ln C_i + \beta * X_i + \varepsilon_i \qquad (1)$$

where $\ln C_i$ is the log of carat weight, X_i is a vector of diamond's features, α, δ and β are parameters to estimate, and ε_i is a random perturbation. The different covariates introduced in the regression in addition to carat weight are cut shape, color, clarity, certificate, polish, symmetry and fluorescence. The corresponding estimates are reported in Table 2.

While the interpretation of the estimated coefficients is straightforward in the case of continuous covariates (like carat weight), the situation is slightly more complex in the case of the estimated coefficients of dummy variables. Assuming that ε_i is normally distributed, a consistent and almost unbiased estimator of the proportional impact $\hat{\delta}_{X_k}$ of a dummy variable X_k on the price P is (see Kennedy, 1981):

$$\hat{\delta}_{X_k} = \frac{\exp(\hat{\beta}_k)}{\exp[0.5 * V(\hat{\beta}_k)]} - 1 \quad (2)$$

where $\hat{\beta}_k$ is the OLS estimator of the estimated coefficient β_k associated to X_k and $V(\hat{\beta}_k)$ is its estimated variance.[9] We correct accordingly the marginal impact of the various dummy variables introduced in our hedonic price function in order to comment on unbiased estimates.

Table-2. Hedonic diamond price functions (OLS estimates)

Variables		**(1) All diamonds**		**(2) Brilliant diamonds**		**(3) Brilliant diamonds**	
		coef	**s.e.**	**coef**	**s.e.**	**coef**	**s.e.**
Constant		9.311***	(0.004)	9.294***	(0.005)	9.254***	(0.007)
Weight (in carats)		1.940***	(0.001)	1.960***	(0.001)	1.958***	(0.001)
Cut shape	Asscher	-0.468***	(0.004)				
	Brilliant round	Ref					
	Heart	-0.422***	(0.004)				
	Cushion	-0.461***	(0.002)				
	Marquise	-0.425***	(0.003)				
	Oval	-0.453***	(0.003)				
	Pear	-0.449***	(0.003)				
	Princess	-0.457***	(0.002)				
	Radiant	-0.479***	(0.003)				
	Triangular	-0.509***	(0.009)				
	Emerald	-0.497***	(0.002)				
Colour	Exceptional white + (D)	Ref		Ref		Ref	
	Exceptional white (E)	-0.080***	(0.002)	-0.091***	(0.003)	-0.090***	(0.003)
	Rare white + (F)	-0.128***	(0.002)	-0.145***	(0.003)	-0.144***	(0.003)
	Rare white (G)	-0.208***	(0.002)	-0.225***	(0.003)	-0.225***	(0.003)
	White (H)	-0.317***	(0.002)	-0.317***	(0.003)	-0.317***	(0.003)
	Slightly tinted white (I-J)	-0.505***	(0.002)	-0.502***	(0.003)	-0.502***	(0.003)
	Tinted white (K-L)	-0.804***	(0.003)	-0.809***	(0.003)	-0.808***	(0.003)

[9] The exact sampling distribution of this unbiased estimator is further investigated in Giles, D., 2011.

	Tinted color (M-Z)	-1.101***	(0.004)	-1.135***	(0.005)	-1.133***	(0.005)
Clarity	Flawless - Internally Flawless (FL - IFL)	Ref		Ref		Ref	
	Very Very Slightly Included (VVS1)	-0.108***	(0.003)	-0.080***	(0.004)	-0.079***	(0.004)
	Very Very Slightly Included (VVS2)	-0.200***	(0.003)	-0.173***	(0.003)	-0.170***	(0.003)
	Very Slightly Included (VS1)	-0.282***	(0.003)	-0.261***	(0.003)	-0.257***	(0.003)
	Very Slightly Included (VS2)	-0.378***	(0.003)	-0.376***	(0.003)	-0.372***	(0.003)
	Slightly Included (S1)	-0.529***	(0.003)	-0.534***	(0.003)	-0.529***	(0.003)
	Slightly Included (S2)	-0.675***	(0.003)	-0.669***	(0.003)	-0.665***	(0.003)
	Slightly Included (S3)	-0.843***	(0.005)	-0.822***	(0.006)	-0.817***	(0.006)
	Included (I1-I3)	-0.976***	(0.004)	-0.971***	(0.004)	-0.967***	(0.004)
Certificate	Gemological Institute of America (GIA)	0.102***	(0.002)	0.131***	(0.003)	0.123***	(0.003)
	European Gemological Laboratory (EGL)	-0.159***	(0.002)	-0.226***	(0.003)	-0.234***	(0.003)
	Other laboratories	Ref		Ref		Ref	
Polish	Excellent	0.024***	(0.001)	0.029***	(0.002)	0.027***	(0.002)
Symmetry	Excellent	0.048***	(0.001)	0.032***	(0.002)	0.023***	(0.002)
Fluorescence	None	0.074***	(0.003)	0.091***	(0.003)	0.090***	(0.003)
	Faint	0.069***	(0.003)	0.084***	(0.004)	0.081***	(0.004)
	Medium	0.035***	(0.003)	0.040***	(0.004)	0.038***	(0.004)
	Strong - very strong	Ref		Ref		Ref	
Optimal depth (59-62.5%)						0.032***	(0.001)
Optimal table (55-58%)						0.004***	(0.001)
Culet	None					0.033***	(0.004)
	No information					0.025***	(0.004)
	Other					Ref	
Number of observations		112,080		63,717		63,717	
R^2		0.976		0.977		0.977	

Source: authors' calculations using data from *Info Diamond*.

Note: estimates from OLS models, with standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10%.

In a first specification (column 1, Table 2), we consider the whole sample comprising 112,080 diamonds. The fit of the model appears impressive since 97.6% of the price variation is explained by our selected covariates. The various explanatory variables are all highly significant, which is not really surprising given the large size of our sample. Net of the influence of the various diamond features, we obtain a convex profile for the carat-price relationship. Specifically, a one percent increase in weight increases the price of the diamond by 1.94%. Larger stones are thus much more expensive on average. Evaluated at the means of the sample, the average price of a 3 carats diamond is 44,721 euros. For a 4.5 carats diamond (a 50% increase), the average price rises to 98,204 euros (so an increase of 120%).

There are substantial differences in diamond prices depending on cut shape. As shown in Table 2, brilliant diamonds are much more expensive on average. Heart and marquise diamonds are about 34% cheaper, and asscher, cushion, oval, pear and princess diamonds are 36-37% cheaper. The decrease ranges from 38 to 40% for radiant, triangular and emerald diamonds. Our data show that the whiter the color, the higher the value of the diamond. With respect to an exceptional white + diamond (D grade), the price is reduced by 7.7% for an E grade, 12% for an F grade and 18.7% for a G grade. Tinted diamonds are much cheaper, respectively -55.2% for a tinted white and even -66.7% for a tinted color diamond. The clarity grade of a diamond strongly affects the price. Diamonds that are almost pure are rare and therefore more expensive. With respect to clarity flawless stones (FL-IFL), the reduction in price amounts to 10.2% for grade VVS1, 18.2% for grade VVS2, 24.6% for grade VS1 and 31.5% for grade VS2. The fall ranges from 49.1% to 56.9% for S1-S3 grades and even 62.3% for (I1-I3) with visible inclusions. Diamonds with excellent polish and excellent symmetry also fetch premium prices, respectively +2.4% and +4.9%. According to our estimates, fluorescence is perceived as a defect. Compared to diamonds having a strong or very strong fluorescence, diamonds with no fluorescence are sold 7.7% higher.[10] Finally, our estimates indicate that there are significant differences in the average price of diamonds depending on their certificates. Stones certified by GIA are 10.7% higher, while stones certified by EGL sell at a 14.7% discount. GIA is considered as the most reputed laboratory for gem evaluation, as it has developed the first internationally accepted Diamond Grading System. It should be noted that these differences in certification are net of the weight effect. Indeed, the GIA laboratory issues reports on a majority of high quality diamonds over one carat in size.

As there are significant differences in the average price between brilliant stones and the other cut shapes, we estimate a hedonic price function for brilliant round diamonds in column 2. Again, price is very predictable since the R^2 is equal to 0.977. In fact, there is very little difference when comparing the estimates reported respectively in columns 1 and 2. For instance, the price elasticity with respect to weight is 1.96 for brilliant stones instead of 1.94 when considering all types of cut shape. As previously found, the price of a diamond decreases when color is poor, when there are inclusions and when it is fluorescent. Conversely, diamonds with excellent polish, excellent symmetry and a GIA certification have a higher value on average. We add three additional variables pertaining to the ideal cut of a diamond in column 3, the sample still being restricted to brilliant stones. According to the OLS estimates, the price increases by 3.3% when the depth is optimal (comprised between 59 and 62.5%), but only 0.04% when the table is optimal (comprised between 55 and 58%). The characterization of the culet also significantly affects the price of a stone. The price increases by 3.3% when the stone has no culet and by 2.6% when the information is not available. However, despite their significance, these additional covariates do not improve the global fit of the model that remains nonetheless remarkably high (0.977). As they stand, our results

[10] Interestingly, the visible effects of faint (+7.1%) or even medium (+3.5%) fluorescence are mainly perceptible to gemologists using a special UV light source.

show that there is little unobserved heterogeneity within the diamond price levels. This undoubtedly explains why there are so many diamond price calculators available on the Internet.[11] Interestingly, in many cases very few characteristics are proposed to determine a price. On the website of *Info Diamond* for instance, users have to select only a cut shape, a weight in carat, a clarity and a color to get an estimate of the diamond price. This suggests that these covariates are the most influential predictors of the stone's price. We decided to test the relevance of this assertion by drawing on a decomposition methodology described in (Fields, 2003). The following technique allows us to assess the respective contribution of the various diamonds' characteristics to their price. Consider the linear model $\ln P = \sum_k \beta_k X_k + \varepsilon$, with $k = 1, \ldots, K$. Then, the variance of the log price may be decomposed as:

$$V(\ln P) = \sum_k \mathrm{cov}(\beta_k X_k, \ln P) + \mathrm{cov}(\varepsilon, \ln P) \tag{3}$$

The relative contribution of each covariate and of the residual is given by the following equality $\sum_k \mathrm{s}(X_k) + s(\varepsilon) = 100\%$, with $\mathrm{s}(X_k) = \mathrm{cov}(\beta_k X_k, \ln P)/V(\ln P)$ and $s(\varepsilon) = \mathrm{cov}(\varepsilon, \ln P)/V(\ln P)$. Each component $\mathrm{s}(X_k)$ provides a measure of the weight of the regressor X_k on the outcome $\ln P$, so that $\sum_k \mathrm{s}(X_k)$ is simply equal to the conventional R^2. In Table 3, we present results from decomposition respectively for the whole sample and for brilliant diamonds. Our main finding is that carat weight has an enormous influence on the price of a diamond: the contribution of carat weight to price amounts to 94.7% and even 95.2% for brilliant diamonds. Interestingly, many websites suggest that carat weight is not enough to price a diamond accurately. Strictly speaking, this statement is not false as, from a statistical viewpoint, many other factors significantly affect the value of a diamond as highlighted in Table 2. However, we also need to put this statement into perspective as the impact of the other diamond features appears much more marginal (and most often negligible). Among the remaining covariates, it is essentially clarity (2.5%) and to a lesser extent cut shape (0.9%) that play a role.

Table-3. Fields decomposition of diamond's price

Variables	All cut shapes				Brilliant diamonds			
	0.5 carat	1 carat	1.5 carats	All	0.5 carat	1 carat	1.5 carats	All
Weight (in carats)	-	-	-	94.7%	-	-	-	95.2%
Cut shape	28.2%	30.9%	26.5%	0.9%	-	-	-	-
Colour	21.7%	22.1%	26.2%	-0.3%	30.4%	31.6%	38.3%	-0.2%
Clarity	36.4%	28.7%	27.9%	2.5%	54.2%	44.2%	36.7%	3.1%
Certificate	3.6%	5.7%	10.0%	-0.4%	5.5%	10.7%	16.9%	-0.7%
Polish	1.2%	1.5%	0.7%	0.1%	1.1%	1.3%	0.2%	0.1%
Symmetry	2.1%	2.5%	1.1%	0.2%	1.4%	2.0%	0.6%	0.1%
Fluorescence	-0.1%	0.1%	0.3%	0.0%	0.2%	0.4%	0.5%	0.0%
Residual	6.8%	8.5%	7.3%	2.4%	7.2%	9.9%	6.9%	2.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Number of observations	5,985	5,555	1,856	112,080	4,515	3,034	1,143	63,717
R^2	0.932	0.914	0.927	0.976	0.928	0.902	0.931	0.977

Source: Authors' calculations using data from *Info Diamond*.

[11] For instance, a basic search of the expression "diamond price calculator" on *Google* yields 63500 hits. A calculator is available on Info Diamond at http://www.info-diamond.com/others/diamond-prices.html.

The next step is to assess the relative contribution of the diamond features net of its weight. For that purpose, we estimate a set of size-specific OLS regressions for stones weighing respectively 0.5, 1 and 1.5 carats. As shown in Table 3, the fit of the various linear models is always very good since the R^2 is never lower than 0.9. Our results are twofold. First, when considering all cut shapes, we find that cut shape, color and clarity are the three main predictors of price since their contribution explains more than 80% of the total price variation. By comparison, symmetry, polish, fluorescence and certificate have much less influence. Secondly, we note that the respective contribution of the selected stone's features depends on carat weight. For instance, clarity explains 36.4% of price for a 0.5-carat diamond instead of about 28% for 1-1.5 carats diamonds. Similarly, the contribution of color seems to increase with weight whatever the diamond's cut shape.

Thus our results suggest that the effect of the diamond's characteristics is likely to be different at different points of the price distribution. We further investigate this issue in the next section, using a quantile regression framework.

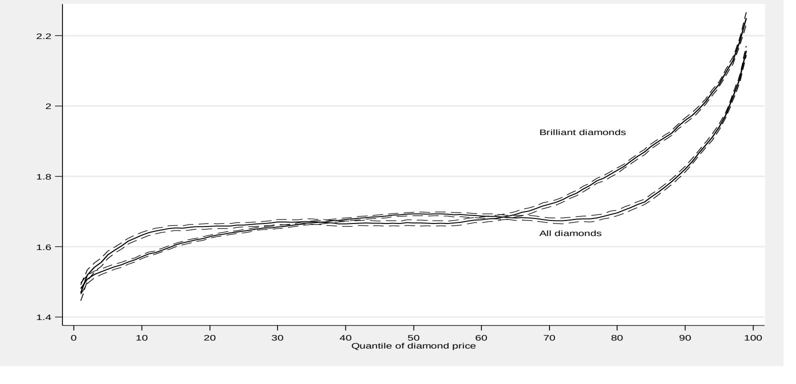
DOES PRICE ELASTICITY REMAIN CONSTANT ALONG THE PRICE DISTRIBUTION?

We estimate quantile regressions to determine whether the effect of carat weight and other diamond features remains constant along the price distribution. Quantile regressions focus on specific parts of the conditional distribution of the dependent variable (Koenker and Bassett, 1978). These regressions provide estimates that are robust to misspecification errors related to non-normality and heteroskedasticity. Let us first focus on the relationship between price and carat weight. For that purpose, we estimate a set of conditional quantile regressions:

$$q_\theta\,(\ln P_i) = \alpha(\theta) + \delta(\theta) * \ln C_i \tag{4}$$

with q_θ the θth conditional quantile of the log price. The coefficients obtained for the carat weight respectively for the whole sample and for brilliant stones are represented in Figure 4.

Figure-4. Conditional quantile estimates of the diamond price-weight relationship



Source: Authors' calculations using data from *Info Diamond*.

Interestingly, we observe a non-linear, increasing profile of the carat coefficient, meaning that the price elasticity with respect to weight is rising along the price distribution. Specifically, the profile is slightly increasing till the 50th percentile, then the price elasticity remains fairly constant until the 80th percentile, rising sharply after that point. The carat weight coefficient, for instance, is equal to 1.70 at the 80th percentile, 1.82 at the 90th percentile, 1.94 at the 95th percentile and even 2.16 at the 99th percentile (the 90th percentile corresponds to a weight of 2.02 carats).[12] There is thus a rising premium for the largest stones. Since these diamonds are the rarest, they are also the most coveted by wealthy investors. The increased demand, essentially attributed to a pure wealth effect around the world, tends to drive prices up even higher.

More generally, we expect all the diamonds' characteristics to have a different effect at different levels of the price distribution. A difficulty with the conditional quantile framework proposed by Koenker and Bassett (1978) is that these regressions do not provide estimates of the impact of changes in the distribution of covariates on the marginal quantiles of the outcome variable. To deal with this issue, Firpo *et al.* (2009) have recently proposed a modified regression framework called unconditional quantile regressions. The method consists of using a recentered influence function (RIF hereafter), which represents the influence of an individual observation on a given distributional statistic. Let $IF(Y; q_\theta, F_Y)$ be the influence function of the θth quantile. Then, the recentered influence function is given by :

$$RIF(Y; q_\theta, F_Y) = q_\theta + IF(Y; q_\theta, F_Y) \tag{5}$$

with $IF(Y; q_\theta, F_Y) = \left[\theta - 1_{Y \le q_\theta}\right]/f_Y(q_\theta)$. Formally, $RIF(Y; q_\theta, F_Y)$ is computed by estimating the sample quantile q_θ, the density $f_Y(q_\theta)$ at the point q_θ (using a kernel method for instance), and by forming a dummy variable equal to 1 when $Y \le q_\theta$ and 0 otherwise. The unconditional quantile regressions are then obtained by estimating a simple OLS regression of the new dependent variable $RIF(Y; q_\theta, F_Y)$ on the set of explanatory factors X.[13]

Table 4 reports the RIF-OLS estimated coefficients of the log price model. We first focus on the impact of the diamond's characteristics other than weight. They strongly depend on the location in the price distribution. The marginal effect of cut shape is for instance much lower on the bottom part of the price distribution, except for princess and marquise. Compared to brilliant stones, other shapes are significantly cheaper and the difference in price strongly increases as one considers more and more expensive stones. The coefficient of almost all shapes is more than 3 times higher at the 90th percentile than at the 10th percentile.

[12] The shape of the price-weight curve is slightly different when the sample is restricted to brilliant stones. The profile increases strongly till the 10th percentile, then remains rather flat until it increases again sharply after the 70th percentile.

[13] More complex estimation techniques are further described in Firpo et al. (2009). Their results suggest that turning to a non-parametric method, for instance, has very little effect on the magnitude of the unconditional quantile estimates.

The impact of poor colors (from K-L to M-Z) is highly detrimental both for low and high diamond prices. Conversely, with respect to the best grade D, there is a fall in price for E and F colors that significantly increases at the 90th percentile. A similar profile is found for clarity. Poor clarity strongly reduces price whatever the stone's value, but the negative effect of very slight inclusions is much higher at the top of the distribution. Finally, the unconditional estimates show that excellent polish, excellent symmetry and lack of fluorescence have a higher payoff in the upper part of the price distribution (75th percentile), but not really at the top (90th percentile). All these findings suggest that there is no place for small imperfections among the most expensive stones.

We next considered the weight coefficient. As previously highlighted with the row conditional estimates of Figure 4, the marginal impact of carat weight does not remain constant along the price distribution. The effect of carat weight is much smaller at the bottom of the distribution (with a coefficient of 0.908 at the 10th percentile) than at the top (with a coefficient of 2.598 at the 90th percentile). So, the price elasticity of diamond with respect to weight is nearly three times higher for the largest stones. It is interesting here to compare the RIF-OLS unconditional quantile estimates with the conditional quantile estimates.

Table-4. Hedonic diamond price functions (unconditional quantile estimates)

Variables	Q10		Q25		Q50		Q75		Q90	
	coef	s.e.	coef	s.e.	coef	s.e.	coef	s.e.	coef	s.e.
Constant	7.836***	(0.021)	8.323***	(0.028)	8.922***	(0.021)	10.031***	(0.030)	11.235***	(0.044)
Weight (in carats)	0.908***	(0.007)	1.719***	(0.008)	1.787***	(0.005)	2.663***	(0.007)	2.598***	(0.013)
Cut shape Asscher	-0.280***	(0.017)	-0.267***	(0.022)	-0.357***	(0.020)	-0.809***	(0.028)	-0.719***	(0.041)
Brilliant round	Ref		Ref		Ref		Ref		Ref	
Heart	-0.188***	(0.024)	-0.384***	(0.028)	-0.475***	(0.019)	-0.640***	(0.027)	-0.572***	(0.032)
Cushion	-0.181***	(0.010)	-0.151***	(0.012)	-0.426***	(0.010)	-0.907***	(0.014)	-0.771***	(0.019)
Marquise	-0.337***	(0.020)	-0.334***	(0.020)	-0.439***	(0.015)	-0.601***	(0.021)	-0.524***	(0.026)
Oval	-0.112***	(0.015)	-0.166***	(0.020)	-0.480***	(0.016)	-0.800***	(0.021)	-0.718***	(0.028)
Pear	-0.147***	(0.013)	-0.221***	(0.017)	-0.484***	(0.013)	-0.779***	(0.017)	-0.706***	(0.021)
Princess	-0.483***	(0.011)	-0.513***	(0.011)	-0.373***	(0.007)	-0.527***	(0.011)	-0.501***	(0.014)
Radiant	-0.189***	(0.012)	-0.211***	(0.016)	-0.514***	(0.013)	-0.833***	(0.017)	-0.701***	(0.025)
Triangular	-0.212***	(0.050)	-0.343***	(0.057)	-0.498***	(0.041)	-0.718***	(0.068)	-0.821***	(0.083)
Emerald	-0.260***	(0.011)	-	(0.014)	-	(0.012)	-0.871***	(0.018)	-	(0.024)

			0.257***		0.414***				0.868***	
Colour D	Ref		Ref		Ref		Ref		Ref	
E	-0.067***	(0.010)	-0.066***	(0.013)	-0.052***	(0.009)	-0.083***	(0.012)	-0.119***	(0.016)
F	-0.132***	(0.010)	-0.030**	(0.012)	-0.043***	(0.009)	-0.124***	(0.012)	-0.276***	(0.017)
G	-0.173***	(0.010)	-0.062***	(0.012)	-0.055***	(0.009)	-0.265***	(0.013)	-0.454***	(0.018)
H	-0.272***	(0.011)	-0.189***	(0.013)	-0.219***	(0.009)	-0.390***	(0.013)	-0.529***	(0.019)
I-J	-0.357***	(0.011)	-0.336***	(0.013)	-0.421***	(0.009)	-0.685***	(0.013)	-0.780***	(0.018)
K-L	-0.559***	(0.016)	-0.761***	(0.018)	-0.658***	(0.012)	-1.057***	(0.018)	-0.978***	(0.025)
M-Z	-0.852***	(0.029)	-1.103***	(0.028)	-0.931***	(0.019)	-1.291***	(0.029)	-1.242***	(0.037)
Clarity FL - IFL	Ref		Ref		Ref		Ref		Ref	
VVS1	0.009	(0.012)	-0.064***	(0.020)	-0.115***	(0.014)	-0.130***	(0.021)	-0.155***	(0.031)
VVS2	-0.079***	(0.012)	-0.134***	(0.019)	-0.164***	(0.014)	-0.241***	(0.021)	-0.263***	(0.031)
VS1	-0.225***	(0.012)	-0.241***	(0.018)	-0.187***	(0.013)	-0.325***	(0.020)	-0.299***	(0.029)
VS2	-0.424***	(0.012)	-0.345***	(0.018)	-0.238***	(0.013)	-0.391***	(0.020)	-0.448***	(0.030)
S1	-0.468***	(0.012)	-0.413***	(0.018)	-0.333***	(0.013)	-0.601***	(0.020)	-0.780***	(0.029)
S2	-0.458***	(0.012)	-0.422***	(0.018)	-0.498***	(0.014)	-0.951***	(0.020)	-0.995***	(0.030)
S3	-0.507***	(0.024)	-0.555***	(0.031)	-0.827***	(0.023)	-1.206***	(0.032)	-1.109***	(0.041)
I1-I3	-0.933***	(0.024)	-0.997***	(0.025)	-0.869***	(0.017)	-1.094***	(0.025)	-0.907***	(0.033)
Certificate GIA	0.141***	(0.012)	0.124***	(0.014)	0.095***	(0.011)	0.182***	(0.015)	0.046**	(0.022)
EGL	0.113***	(0.013)	0.063***	(0.015)	-0.066***	(0.012)	-0.273***	(0.017)	-0.537***	(0.024)
Others	Ref		Ref		Ref		Ref		Ref	
Polish Excellent	-0.072***	(0.007)	-0.028***	(0.008)	0.037***	(0.006)	0.112***	(0.008)	0.056***	(0.011)
Symmetry Excellent	0.022***	(0.008)	-0.007	(0.009)	0.006	(0.006)	0.139***	(0.009)	0.085***	(0.013)
Fluorescence None	0.013	(0.014)	0.019	(0.017)	0.123***	(0.013)	0.178***	(0.018)	0.043*	(0.025)

Faint	-0.019	(0.016)	-0.053***	(0.019)	0.092***	(0.014)	0.196***	(0.020)	0.102***	(0.028)
Medium	-0.030*	(0.017)	-0.017	(0.020)	0.045***	(0.015)	0.126***	(0.021)	0.060**	(0.030)
Strong - vstrong	Ref		Ref		Ref		Ref		Ref	
Number of observations	112,080		112,080		112,080		112,080		112,080	

Source: authors' calculations using data from *Info Diamond*.

Note: estimates from OLS models, with standard errors in brackets. Significance levels are respectively 1% (***), 5% (**) and 10%.

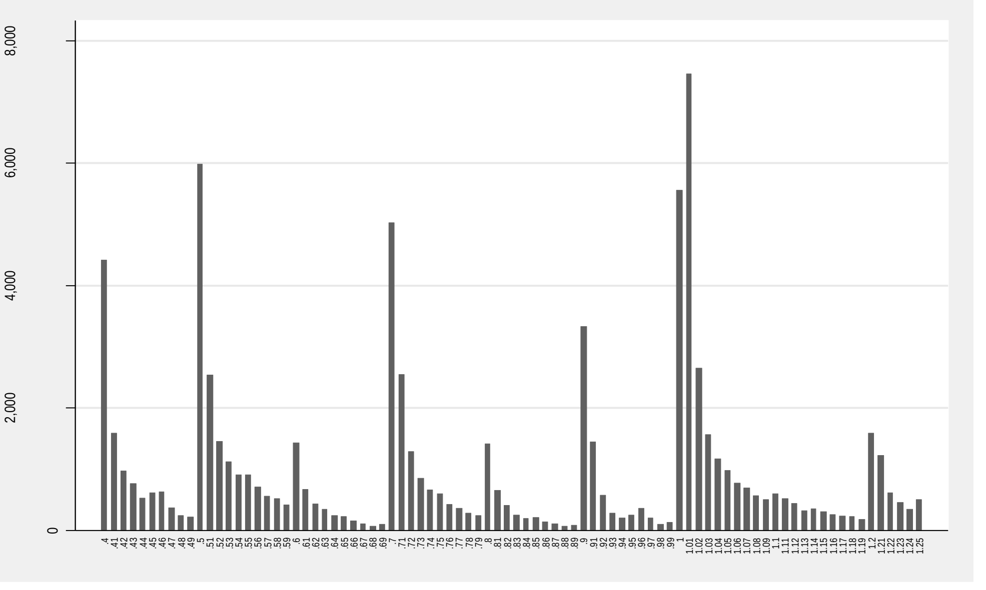
We find much less variation in the weight coefficient along the distribution since the conditional estimates are respectively 1.906 at the 10th percentile, 1.951 at the 50th percentile, and 2.008 at the 90th percentile.[14] On the one hand, the conditional estimates show that the carat weight increases the price dispersion within groups, defined as diamonds characterized by similar values of the covariates *X* (other than carat). On the other hand, there is a premium for the largest stones and thus there is an inequality-enhancing effect between groups of diamonds. So the between and within group effects go in the same direction. This explains why the unconditional price-weight estimates are much larger than the conditional ones.

DISCONTINUITY IN THE CARAT-PRICE RELATIONSHIP

So far, we have assumed in our empirical analysis that the weight-price relationship is continuous. Interestingly, the pattern described by Scott and Yelowitz (2010) suggests that there are significant discontinuities in both price and quantities when considering the market of diamonds. For instance, a diamond that is one-half carat is on average 18% more expensive than a diamond that is slightly less than a half carat. As a preliminary step, we decided to look closely at the weight distribution of the selected diamonds. As shown in Figure 5, we can observe the existence of strong discontinuities in the number of diamonds by size. Indeed, the frequency of diamonds whose weight is round appears to be much higher. For example, there are 4422 diamonds whose weight is 0.4 carat, but only 1590 whose weight is 0.41 carat. When considering weights around 0.5 carat, the sample includes 5985 diamonds of 0.5 carat against 215 of 0.49 carat and 2539 of 0.51 carat. While the number of diamonds weighting 0.01 carat less is much smaller compared to diamonds with a round weight, we also note that sometimes the number of diamonds with +0.01 additional carat is substantially higher.

[14] Estimates from the conditional quantile regressions are available from the authors upon request.

Figure-5. Number of diamonds by carat weight



Source: Authors' calculations using data from *Info Diamond*.

Note: The sample is restricted to diamonds whose weight is comprised between 0.4 and 1.25 carats.

This pattern is essentially found for diamonds exceeding 1 carat. For instance, there are 5555 diamonds of 1 carat in our sample, a figure to compare to 7460 diamonds weighting 1.01 carat. Similarly, there are 20 diamonds whose weight is 1.99 carat, 984 with 2 carats, 1961 with 2.01 carats and 918 with 2.02 carats. A simple explanation of these discontinuities in weight could be a certain risk aversion on the part of suppliers. If diamond producers expect their gemstones to be less sought after if they fall just below certain threshold (round) values, then they would be tempted to produce diamonds just equal to or slightly above the thresholds when cutting the gems. In their study, Scott and Yelowitz (2010) report large discontinuities in prices and interpret them as price anomalies. As a preliminary step, without controlling for any features of the diamonds, we decided to compare the row prices of the gems by considering successive intervals of 0.2 carat. From the Least Absolute Deviations estimates reported in column 1 of Table 5, we find significant increases in prices for diamonds featured with round weights. For example, the price of a diamond of 0.5 carat is +57.7% higher than that of 0.49-carat diamond. The rise is respectively +27.9% between 0.59 and 0.6 carat, +33.6% between 0.69 and 0.7 carat, +20.2% between 0.79 and 0.8 carat, +40.3% between 0.89 and 0.9 carat, and +39.6% between 0.99 and 1 carat. We find less convincing evidence when considering diamonds above 1 carat, the discontinuity in price being much lower.[15]

[15] The increase is equal to +1.2% between 1.09 and 1.1 carat, -0.7% between 1.19 and 1.2 carat and +4.7% between 1.29 and 1.3 carat. Nevertheless, the discontinuity in price is again higher for heavier diamonds (+25.9% between 1.39 and 1.4 carat, +35.4% between 1.49 and 1.5 carat).

Table-5. Effect of a 0.01-carat increase on price at focal weights

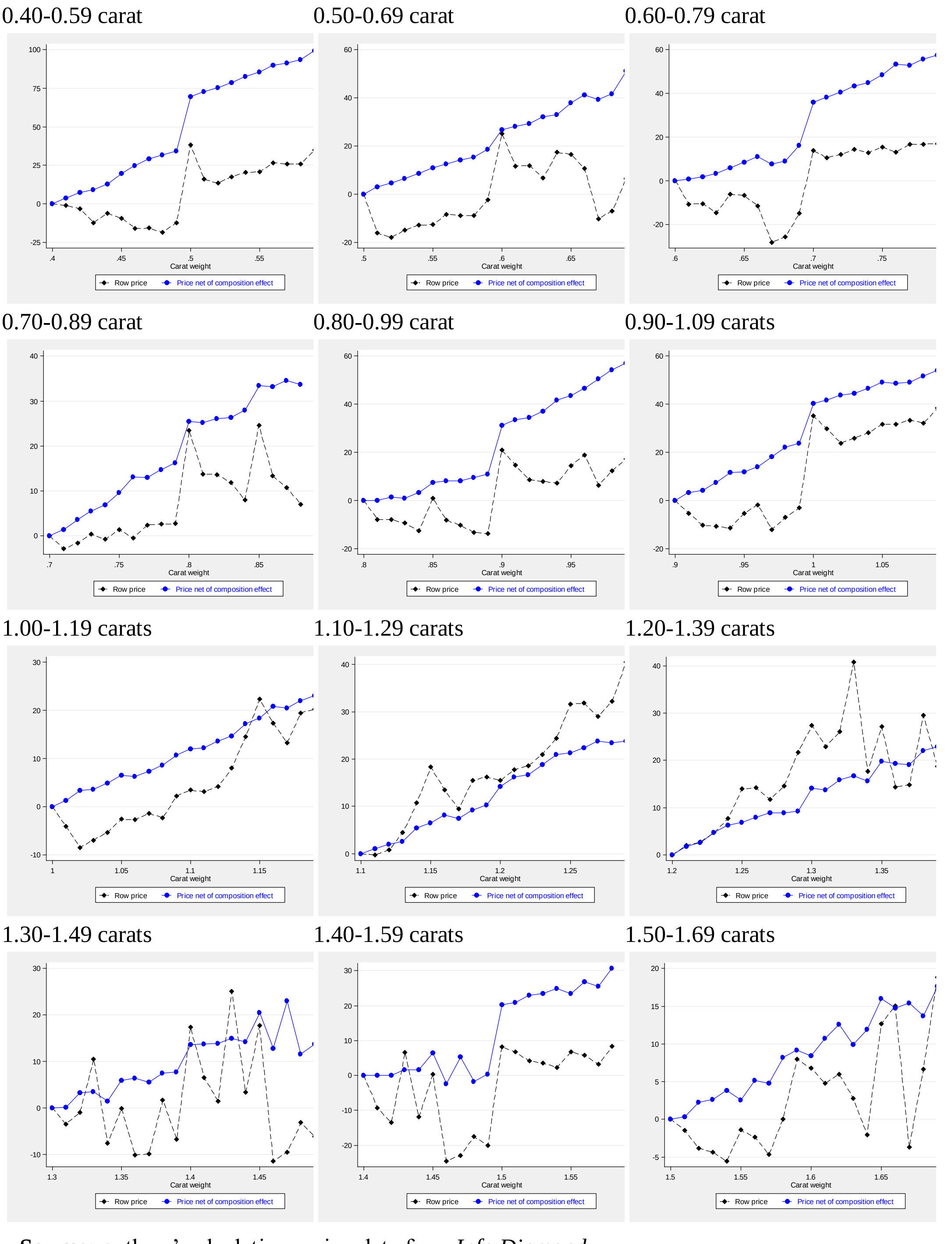
Focal carat weight	Effect of a 0.01-carat increase on price		Number of Diamonds	Number of variety
	Row increase	Net increase		
0.5	57.7 [46.8;68.6]	26.2 [24.2;28.2]	5985	366
0.6	27.9 [19.9;36.0]	6.8 [5.6;8.1]	1428	225
0.7	33.6 [24.4;42.8]	17.1 [14.5;19.7]	5026	397
0.8	20.2 [14.7;25.6]	7.9 [6.4;9.4]	1414	301
0.9	40.3 [29.1;51.4]	18.2 [15.0;21.4]	3331	423
1.0	39.6 [28.4;50.8]	13.3 [10.6;16.1]	5555	502
1.1	1.2 [-5.3;7.6]	1.2 [-0.6;2.9]	596	237
1.2	-0.7 [-8.6;7.3]	3.6 [1.5;5.6]	1589	315
1.3	4.7 [-6.0;15.3]	4.4 [2.3;6.6]	553	182
1.4	25.9 [2.4;49.4]	5.5 [1.6;9.4]	270	118
1.5	35.4 [10.6;60.3]	20.1 [14.9;25.2]	1856	316
1.6	-1.1 [-12.5;10.3]	-0.7 [-3.3;1.9]	267	130

Source: Authors' calculations using data from *Info Diamond*.

Note: estimates from LAD regressions. Confidence interval at the 95 percent level. Each variety is a combination of one cut-shape (11 possibilities), one color (8 possibilities) and one clarity (9 possibilities).

We report the change in price as a function of weight over the various intervals in Figure 6. Interestingly, we find that the curve of the row prices is rather flat and even sometimes negative before the mid values of the interval. If we consider for instance the case of diamonds ranging from 0.4 to 0.59 carats, the row price of a gem is 9.2% lower for a diamond of 0.45 carat compared to a diamond of 0.4 carat. These figures are 15.8% for 0.46 carat, 15.7% for 0.47 carat, 18.4% for 0.48 carat and 12.4% for 0.49 carat. The phenomenon is clearly observed up to 1.1 carats, while the shape is less clear beyond. The gross price curve tends to grow from 1.1 to 1.3 carats, while there are many more fluctuations above (this is presumably related to the much smaller sample sizes).

Figure-6. Discontinuity in diamond price, by carat weight



Source: **a**uthors' calculations using data from *Info Diamond*.

Note: Price increases are obtained from Least-Absolute Deviation estimates.

At first sight, this pattern is very surprising. A consumer interested in buying a diamond will probably not understand why buying a gem with 0.05 additional carat would be cheaper compared to the corresponding round weight. A simple explanation could be that the cut of diamonds leads to a selection effect so that gems far from round prices have less attractive characteristics. In column 2 of Table 5, we control for the composition effect of the diamonds. Once the objective characteristics of the diamonds are taken into account, we find a different relationship between the price of diamonds and their weights.

As shown in Figure 6, we now observe an increasing profile between price and weight, with a jump at exactly the round quantity. For instance, the transition from 0.49 to 0.50 carats leads to an increase of +26.2% in the diamond price against 57.7% without controlling for the composition effect. The increase in price is 13.3% from 0.99 to 1 carat (the row jump was equal to +39.6%) and 20.1% from 1.49 to 1.5 carats (the row increase was 35.4%). Thus our results highlight the importance of taking the other diamond features into account when explaining prices. On average, the quality of diamonds whose weight is just below the round weight tends to be lower. This explains why net of the composition effect we never observe any decrease in price for larger gems.

DISCUSSION AND CONCLUDING COMMENTS

In this paper, we have used a unique dataset on more than 100,000 diamonds to bring evidence on the relationship between the price setting of diamonds and their weight. Drawing on decomposition techniques and unconditional quantile regressions, our framework based on hedonic price functions à la Rosen leads to the three following results. First, the weight in carat is the main predictor of the diamond value as it explains about 95% of variation in price. Secondly, the weight-price elasticity, which is around 2 at the mean values of the sample, is rising along the price distribution of diamonds. Thirdly, we find substantial increases in price for gems with round weights compared to gems just below these round weights. These discontinuities were recently described in Scott and Yelowitz (2010), who consider them price anomalies.

Attempting to rationalize these jumps in price is a challenging issue. From our own results, we suggest the following explanation. On the demand side, consumers are looking for diamonds of high quality (remembering that diamonds are eternal), which means that price is presumably not the sole purchase criterion. If diamonds just below round weights are perceived as diamonds of lower quality, then consumers would have a strong preference for round weight diamonds. This would lead to a discontinuous demand, higher on focal points because diamonds are better at these points. On the supply side, producers would cut their stones to meet this increased demand. The fact that the weight in carats is a round number becomes in itself an indicator of quality of the diamond.

Unfortunately, with the supply data at hand (nothing is known about purchases), it is not possible to better assess the causality in the relationship between supply and demand. It may be that producers deliberately keep their best stones for carving in round weight, but it is also possible that consumers have shifted their preferences by discovering that the quality of diamonds whose weight is not round was lower. Whether increased demand at focal points shapes the cut of gems or whether consumers expect gems with round weights to be of higher quality remains moot. Whatever the case, the good news from our empirical analysis is that consumers wishing to buy a diamond can make substantial savings by purchasing a gem with a weight just slightly lower (0.01 carat less is most often enough) than the one originally intended.

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