Original Research Article

Gold Jewellery Demand and Gold Price Volatility: A Global Perspective

Abstract

Profound changes have occurred in the gold jewellery market which has experienced a secular decline in demand over the last twenty years. Despite the apparent growth in gold jewellery demand in India and China over the last two decades there has been a more than compensatory decline in demand for gold jewellery in the rest of the world. This has meant that the industrial uses of gold have been in decline with other traditional uses in dentistry declining even more rapidly than that of jewellery. As a result, the investment uses of gold in the form of gold bars coins and ETFs have had to absorb the increased supply that resulted from the price boom of 2011-2012. The paper argues that the demise of gold jewellery demand along with other traditional uses has resulted in a significant increase in the long term gold price volatility.

Key words: Gold, jewellery, price volatility

Introduction & Background

The global market for gold has undergone a fundamental and profound change stemming from the rise of India and China as key markets and, more importantly, the rapid and secular decline in gold jewellery demand in the rest of the world over a period of twenty years as depicted in Figure 1 & 2 below[1]. The decline in demand has been driven by a shift in demand for luxury goods by Millennials[2] away from gold jewellery consumption (World Gold Council. 2016,World Gold Council 2016a, Zheng, R. 2017, Williams, S. 2017, GFMS Thomson Reuters 2017) This decline, while certainly not as pronounced is even true in the traditional Asian markets where urban elites in first tier cities have recently shown an increasing preference for other luxury products, much like that being experienced in more developed countries. This together with the decrease in the demand for gold as a result of changes in dentistry along with the static demand for gold in electronics has meant that total manufacturing demand has gone into decline over the last twenty years. A number of studies have noted the decline in industrial demand for gold in developed as well as in many developing countries (Jingting Liu,2016, Krijger, M. 2011; Marchia, V, D., Leeb, J., and Gereffic, G. 2013) .

The purpose of this paper is to examine the impact on gold price volatility of the decline in gold jewellery demand and the concomitant increase in investment demand for gold. As we shall see below much of the discussion of gold price volatility addresses the issue of short term fluctuations whereas this paper is concerned primarily with long term trends.

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[1] Aggregate data for the twenty year period 1997-2016 is only available from the World Council. However disaggregated data which includes India and China is only available from the World Gold Council from 2000 onwards.

[2] There is no formal definition of what constitutes a Millennial but it is generally understood to mean someone born between the early 1980's and the early 200's. They are also referred to as generation Y.

Figure 1
Composition of Gold Demand (1997-2016)

Figure 2 below shows the trend in gold jewellery demand both globally and in the two largest markets of India[3] and China. As is evident aggregate demand is in steady state decline just as depicted in Figure 1 and the decreases were particularly pronounced in the wake of the 2008-9 crisis where there was a step-wise decline in demand from which there has yet to be a recovery. This is a result of the twin effects of the economic crisis post-2009 and the rise in gold jewellery prices over the period. What has compensated for the decline in demand in ROW demand has been the rising demand in China and the steady and moderately rising demand in India. I most developed as well as relatively advanced developing countries like Turkey the trend has been for a decrease in demand even in in investment.

The geographic distribution of consumer demand for gold has also changed. Five countries together are responsible for some 65% of global consumer demand. China and India together represent 51% of world consumer demand for gold. With the rise of India and China the market has shifted significantly towards Asia over the past 20 years. While most other sources of demand for gold have been in progressive decline, it has been the surge in investment demand in the form of bars and coins that has buoyed the overall demand for gold over the last decade. In no small measure the decline in demand has been caused by a structural shift in demand for jewellery outside India and China. Even in India and China, a younger generation of urban 'Millennials' is entering the market and have a greater range of possible luxury goods to consume than previous generations. As a result of this structural change the position of gold is becoming more precarious.

Figure 2
Gold usage in the Production of Jewellery

Source: World Gold Council and author's estimates.

There has been considerable debate in the literature in Minerals Economics as to whether the long bull market that occurred in many commodities in the first decade of the current century has been part of a commodity price super-cycle stemming from an increased intensity of use of commodities stemming in turn from the transition of China to a developed economy. While this may be the case with regard to base metals, the evidence of an increased intensity of use of gold does not exist and what evidence does exist suggests that the global intensity of use of gold for industrial purposes for the period 1997-2016 actually halved per dollar of global GDP. This depicted below if Figure 3. Disaggregated data on a country basis does exist from GFMS and it demonstrates that while the intensity of use remained largely unchanged in China over the period it has declined dramatically in India falling to a third of 2003 levels. It should be noted that 2016 was a particularly bad year for gold demand and

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[3] Indian data on gold usage is inflated and unreliable because of the phenomenon of round tripping caused by incentives given the Indian government to the jewellery manufacturing sector Round tripping' is the act of exporting gold, be it jewellery bars or coins, with the sole purpose of melting it down before re-importing it back to the original exporting country. The process results in a circular flow of gold between different countries, serving to inflate trade statistics. The levels involved can be significant and this is one reason why trade statistics should not be taken at face value.' – WGC. (2016). India's Gold Market: Evolution and Innovation. Page 41.

78   usage is widely expected to increase in the coming years as India recovers from the
79   imposition of value added taxes and other measures applied in the gold sector.

80   **Figure 3**

81   **Intensity of Gold Use in Manufacturing (tonnes/ GDP)**

82

83   **Source**: GFMS Thompson Reuters Annual Gold Survey, various years and authors'
84   estimates. It should be noted that GFMS and WGC data are not always consistent. GFMS
85   data is only available from 2003 onwards

86   According to several authors in the area (Bernanke, 1983; Pindyck, 1991; Dixit and
87   Pindyck, 1994), price volatility affects the global economy is two broad ways. Firstly,
88   developing countries that are heavily dependent on the primary industry are adversely
89   affected in terms of their income and their terms of trade. This will ultimately have adverse
90   implications toward economic agents consumption and investment decisions. Second,
91   commodities from the primary industry plays a pivotal role as input in the manufacturing
92   sector, persistent price volatility may trigger an increase in the production cost in the
93   manufacturing sector.

94   The gold price has increased from USD 35.00 per ounce under the Bretton
95   Woods system to USD 631.10 per ounce in 1980 and reached a peak in 2011 to USD 1917.90
96   per ounce. This high price was mainly attributed to the downgrade of the S&P rating on US
97   Treasury bond from AAA to AA+ (Hashim, Ramlan, Razali and Nordin, 2017) though the
98   structural change in the market caused by very substantial increases in demand from
99   liberalized markets in India and China strengthened the bull market. This downgrade in the
100   midst of the recession caused many investors to lose confidence in US currency, and
101   subsequently they shifted their investment towards gold. However, the gold price has
102   experienced a sharp decline since the 2011 peak.

103   By 2016 jewellery and other industrial uses had decreased to 55% of gold end
104   use and the balance made up by demand for financial instruments (bars, coins, ETF and net
105   official purchases)[4]. The structural shift in the demand for gold from a commodity that was
106   principally used in industrial processes some thirty years ago to one which is now dominated
107   by more speculative end uses suggests that there will be an increase in volatility of demand
108   and price. This issue of the shifting composition of gold demand and its impact upon gold
109   price volatility is of great significance that needs further attention to find out how it is
110   affecting gold price volatility as consumers change preferences with new uses of gold and
111   other luxuries competing.

112   Gold is considered widely as being an economic hedge against risks (for example
113   inflation). Today's advancement in financial markets and money has led to golds prominence
114   in 'investment'. 'Investment' due to the different methods that people demand or hold gold,
115   with the major difference being cultural motive. In certain countries, demand for gold is done
116   via the acquisition of jewellery as is the case in India and China where gold jewellery
117   collections are considered a sign of wealth.

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[4] GFMS Thompson Reuters (2017)

118   In other parts of the world, the demand is commonly in the form of gold bars or
119 bullion. Also accumulating wealth but with different methods or practices. Today gold is
120 traded on several exchanges that include among others: the London OTC market, COMEX
121 (New York), Shanghai and in Dubai: Based on GFMS calculations, Over the Counter (OTC)
122 transactions nudged up slightly in 2016, but in general remain in a sideways trend when
123 considered over the last decade. Gold trading on COMEX on the other hand has gained
124 considerable traction over the years, jumping in 2016 year by 38% to represent almost one
125 third of annual OTC trading activity; it's highest on record. However, not all of this demand
126 is of actual gold but speculation on gold prices. As mentioned above, gold is an asset traded
127 globally, which leads to the question of whether there is a relationship between price
128 volatility and several aspects of demand, among others.

129   The concern of gold price volatility has led to researchers to investigate the
130 determinants. However, as the discussion above suggests the structural change of
131 consumption and the downward trend of consumption of gold jewellery is evident. One of the
132 principle driving factors has been rising price. However, given the nature of this precious
133 metal a better understanding of the factors affecting price or its volatility are integral as that
134 would then shed more light in understanding how a commodity of such allure could be in
135 such decline, especially in terms of Jewellery. Whereas the inclusion of other uses apart from
136 jewellery in analyzing the structural shift and declining demand is the limited literature on
137 several practical uses for gold, especially in one study. The main objective is to examine the
138 determinants of gold price volatility resulting from structural shift in demand and the
139 downward trend of consumption of gold globally. To observe if and how demand or
140 consumption of gold affects price volatility of gold and to observe any spillover effects or
141 contagion from the stock markets to gold price volatility.

142   The rest of the paper is organized as follows: the second part presents the literature
143 review on volatility in general and gold price volatility in particular. The methodology is
144 presented in the third section and lastly the results and policy discussion.

145 **Literature review**

146   The theoretical analysis of commodity price volatility normally revolve around the
147 issues of economic uncertainty and therefore tends to be focused on short-term price
148 volatility. While these are considered, this paper is focused on the long term determinants of
149 price volatility which is not commonly the subject of economic theorizing.

150   According to Bernanke (1983), Pindyck (1991), Dixit and Pindyck (1994), price
151 volatility increases economic volatility which hampers investment decisions and thus
152 negatively affecting the macroeconomic fundamentals. This view is also embedded in the
153 'real options' channel that argues that persistent commodity price volatility causes
154 fluctuations on economic fundamentals , that increases uncertainty over expected future cash-
155 flows. This triggers a wait and see approach where entities may defer investment as risk
156 increases (Bloom, 2009). Moreover price volatility has negative implication on demand side
157 effect. This is attributed to the reasoning that persistent volatility increase uncertainty of
158 future prices which may impede the macroeconomic fundamentals through a diametrical
159 effect on consumer demand. In analyzing volatility and more specifically gold price
160 volatility, the ARCH/GARCH models are particularly popular as measures of volatility. Their
161 range varies and specific models in the family are better suited to different data and

162 objectives being pursued. The variation with the models used to model volatility is illustrated
163 in studies by Tully and Lucey (2007), used an APGARCH model (of which they were the
164 first to use an APGARCH investigation of the gold price as they investigated macroeconomic
165 influences on gold); while Toraman, Başarır and Bayramoğlu (2011) used an M-GARCH
166 model; with Harper, Jin, Sokunle, and Wadhwa (2013), using a host of models from the
167 ARCH family, namely: they used GARCH (1, 1), EGARCG (1, 1), and TGARCH (1, 1).

168   With respect to empirical literature on gold price volatility, Lin (2016) has argued that
169 while gold has been studied by economists extensively over many decades little is known
170 about its consumption characteristics: more so reasons for purchasing gold and the qualities
171 consumers' desire, among other things. This study seeks to understand the long term
172 structural shift of gold demand particularly jewellery demand as it pertains to gold price
173 volatility and seeks to shed light on the phenomenon with variables that explain to an extent
174 consumption characteristics and or trends that affect gold price volatility.

175   Tully and Lucey (2007), investigated macroeconomic influences on gold prices
176 volatility using the asymmetric power GARCH model (APGARCH) in which the power term
177 in the model was estimated within the model rather than specified by the authors. To estimate
178 the goodness of fit of each model, likelihood ratio tests were used to assess the significance
179 of each model and provide the best fit for the data. They found that the APGARCH model
180 was a good fit for investigating the conditional volatility of gold prices in the UK.
181 Furthermore, among the variables studied, the US dollar was the only one found to
182 significantly impact the gold price. In the same vein, Domanski and Heath (2007) echoed
183 how commodities have attracted interest as financial instruments over time. In their article,
184 'financial investors and commodity markets', they discuss some factors behind the growing
185 appeal of commodities to investors and assess the extent to which market characteristics, such
186 as price volatility have changed. They find that it is not clear that growing investor activity
187 can have a systematic direct effect on inventory decisions. They suggest that it is more likely
188 that financial investors could indirectly affect inventory decisions through futures prices.
189 However, they find that they remain open, depending on how spot prices respond to possible
190 inventory decisions. They conclude that while physical characteristics such as inventory
191 levels and marginal costs of production remain important, commodity markets have become
192 more like financial markets in terms of the motivations and strategies of participants.

193   Toraman, Başarır and Bayramoğlu (2011) modeled the conditional variance of US
194 gold price using M-GARCH model for the period 1992 to 2010 in which monthly data was
195 used. In which they found, a negative and significant relationship between the return of gold
196 and the return of USA Dollar, with the rest of the variables found to have no significant
197 relationship with the return of gold.

198   Harper, Jin, Sokunle, and Wadhwa (2013), examined the price volatility in the silver
199 spot (cash) market. In which a host of models from the ARCH family were used to analyze
200 and gain a better understanding of the volatility of silver prices. They found the TGARCH
201 (1,1) model indicated that both positive and negative shocks do not have a significant effect
202 on volatility in the silver spot market, while both the GARCH (1,1) and EGARCH (1,1)
203 models indicated that past silver spot price volatility is significant and that volatility is
204 observed to not be constant over time. The results provided evidence that both good and bad
205 news have no significant effect on silver price volatility.

206   Gencer and Musoglu (2014) investigated the shock and volatility transmission
207 mechanisms between gold, and stock/bond markets in Turkey, applying bivariate BEKK-
208 GARCH modeling for gold-stocks and gold bonds pairs respectively. Overall, they observed
209 some significant shock and volatility transmissions at varying magnitudes.

210   Ayele et al (2017) modeled and forecast the gold price volatility using the
211 exponentially weighted moving average (EWMA) and the generalized autoregressive
212 conditional heteroscedasticity (GARCH) models for the period from 1998 to 2014 in
213 Ethiopia. Among the GARCH-type models, GARCH-M (2, 2) with Student's t distribution
214 for the residuals was found to be the best-fit model. The results indicated that exchange rate,
215 saving interest rate and price of crude oil have a significant effect, while inflation was found
216 to be insignificant in determining price. Additionally, previous prices from the last two
217 months were also found to be significant in determining current prices. The risk premium
218 effect was found to be positive and statistically significant, suggesting increased volatility
219 was followed by a higher mean.

220   Natchimuthu, Ram and Hemanth (2017) sought to determine whether gold price
221 volatility in India was leveraged[5]. Their study also examined the impact of US gold price
222 return on the volatility of gold price in India. The results suggested that conditional volatility
223 of gold price in all the six cities in India carried volatility clustering features. They also found
224 that the United States gold returns had a significant influence on the gold price volatility in
225 five out of six Indian cities studied.

226   The literature has thus provided several effects of gold price volatility. However, there
227 is no consensus on the determinants of gold price volatility. The veracity of this, needs to be
228 determined with further empirical work. Examining the underlying long term factors is
229 important to develop well-tailored policy instruments in a volatile market environment.
230 Examining the determinants of gold price volatility is therefore imperative.

231 **Methodology**

232   This study uses quarterly time series data from 1998 quarter one to 2017 quarter three.
233 The period is chosen not only because of data considerations but because it also covers the
234 full trade cycle for gold including the nine year bull run from 2002-2011 as well as the long
235 subsequent decline in gold prices. The quarterly data used is purposeful as it avoids the daily
236 fluctuations in gold prices which are not the subject of this analysis. The data used was
237 collected from various sources including the World Gold Council (WGC), the Federal
238 Reserve Bank of St. Louis, S&P Global and the Bullion vault. The gold price, Jewellery
239 demand and gold uses were extracted from the World Gold Council; the price of silver from
240 the Bullion vault; the Dow Jones Index from S&P Global; whereas, the treasury holdings
241 (that represents quantitative easing) used data from the Federal Reserve Bank of St. Louis

242 *Gold price volatility function*

243 This study adopts the gold price volatility function of Hashim et al (2017) which is stated as:

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[5] Leverage – In this context the use of leverage means the use of various financial instruments or borrowed
capital to increase the return of an investment. Gold importation in India is subsidized as a measure to spur the
development of the jewellery sector.

$$lnGPVol_t = \beta_0 + \beta_1 lnJDD_t + \beta_2 lnQE + \beta_3 lnINV_t$$
$$+ \beta_4 lnPSIL + \beta_5 lnDJI_t + \beta_6 lnCDD_t + \xi_t \quad (1)$$

244 Where:

245   - $GPVol$ -Gold price volatility
246   - JDD - Total world jewellery demand
247   - QE   - Quantitative easing
248   - INV   - Gold for investment use
249   - PSIL   -Silver price
250   - DJI   -Dow Jones Index
251   - CDD   -China gold demand
252   - ξ - Error term

253   Economic theory suggests that β_1 is expected to be negative. An increase in jewellery
254 demand is expected to stabilize gold price volatility while the impact of increased demand for
255 gold for investment purposes would have a positive sign. Whereas the rest of the parameters
256 can carry any sign.

257   Most macroeconomic time series data have been found to have a unit root which
258 means that they are non-stationary and therefore their variances increases with time. If these
259 data are used in regression equations, they yield spurious results. So it is imperative to pre-
260 test all the variables for unit roots before doing any analysis. In this study the Augmented
261 Dickey Fuller (ADF) test was used to test for the stationarity of the variables and the
262 variables were found to be all stationary at first difference. Results are tabulated in Table 1
263 bellow:

264 **Table 1: Unit Root Test**

265 *GARCH Measure of Volatility*

266 In measuring gold price volatility, the study uses an extension of the ARCH model, the
267 Generalised Autoregressive Conditional Heteroscedasticity (GARCH) model, which
268 incorporates moving average processes. A $GARCH(p,q)$ model is specified as:

269 $\sigma^2(\varepsilon_t) = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \cdots + \alpha_q\varepsilon_{t-q}^2 + \beta_1\sigma_{t-1}^2 + \cdots + \beta_p\sigma_{t-p}^2$

270 $\qquad = \alpha_0 + \sum_{i=1}^{q}\alpha_i\varepsilon_{t-i}^2 + \sum_{i=1}^{p}\beta_i\sigma_{t-i}^2$

271 Where p is the order of the GARCH terms σ² and q is the order of the ARCH terms ε².

272 To model a GARCH process, first of all the gold price series is run as an Autoregressive
273 Process (AR) in order to obtain the residuals that are used to generate the volatility series. To
274 determine the appropriate lag length for the model, we use the general to specific
275 methodology, where we start with a lag length of 4 and then trim down the model by the t-
276 test and also using the Akaike Information Criterion (AIC). The AR (p) process is of the
277 form:

$$Goldprice_t = \alpha_0 + \alpha_1 Goldprice_{t-1} + \alpha_2 Goldprice_{t-2} + \cdots + \alpha_p Goldprice_{t-p}$$

278 Table 2: Gold price autoregressive processes

279

280 From the Table 2 above, is it evident that gold price series can be modelled as an AR (2)
281 process. For the second stage is to estimate several low order GARCH estimates of the gold
282 price process and compare their goodness of fit statistics and significance levels. The results
283 are outlined in Table 3 below:

284 Table 3: GARCH estimates

285

286 From the above table, gold price volatility can be modelled as a GARCH (1, 1) process which
287 is stated as $\sigma_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \beta_1\sigma_{t-1}^2$. The results are summarized in the Table 4 below:

288 **Table 4: GARCH Model Results for gold price volatility**

289 *** , * indicates significance at the 1% and 5% level respectively*

290 The sum of the ARCH and GARCH terms are the ones that reveal the magnitude of volatility
291 in a model (α+β). The rule of thumb as laid by Chowdhury (2005) is that if:

292   - $\alpha + \beta$ is close to unity (1), then volatility is present and persistent.
293   - $\alpha + \beta < 0.5$ it indicates that there is no volatility.

294 It is evident from the table above that the sum of ARCH and GARCH coefficients (α+β) is
295 around unity (1.07), this indicates that gold price is volatile and furthermore the volatility
296 persistent. The results of the long –run specification to determine the determinants of gold
297 price volatility as expressed in equation in (1) are given in the Table below:

298 **Empirical results and discussion**

299 After deriving the volatility series, the model in equation 1 was estimated to examine the
300 determinants of gold price volatility. The results are reported in Table 5. From the general
301 statistics it can observed that the value of the F-statistics is 117.28 Prob > F = 0.0000, this
302 shows that the overall fit of the regression is good. Moreover it indicates that the model is
303 significant at 1% significance level, thus, we can proceed with analysis as the parameters are
304 jointly statistically significant different from zero. Table 5 further reports that the goodness of
305 fit is relatively high, as given by the R^2 of about 93%. Majority of the variables are also
306 significant at 5% significance level.

307 Table 5: Long-run regression estimates

308

309   The estimated results report that there is an inverse relationship between gold price
310 volatility and jewellery demand, 1% increase in total jewellery demand will leads to a fall in
311 gold price volatility by about 1.32%, ceteris paribus. This indicates that a decline in jewellery
312 demand will exacerbate gold price volatility while the increases in the investment use of gold
313 will also increase volatility. A current decline in global jewellery demand is therefore among
314 the factors that exacerbates gold price volatility.   Whereas a positive relationship was
315 reported from quantitative easing, the Dow-Jones index, silver price, demand for gold by
316 China and gold investment demand. The results of the modeling suggest that neither the
317 effects of QE nor the impact of Dow-Jones as a proxy for alternative financial instruments are
318 statistically significant in explaining long term gold price volatility.

319   The analysis does not, like many previous studies focus on short term price
320   volatility but that which stems from a long term structural change in the composition of
321   demand. The statistically most significant factors in explaining long term volatility are China
322   demand, global investment demand and the demand for gold for jewellery consumption. That
323   India is not included stems from the unreliability of Indian gold and jewellery data which is
324   in turn driven by round tripping.

325   **Post estimation analysis**

326   The residual diagnostic tests for normality, autocorrelation and heteroscedasticity are
327   reported in Table 6, 7 and 8 respectively. Table 6 depicts that the normality assumption of the
328   residual term has been supported. However, the model suffers from autocorrelation as
329   evidenced from the d-statistics in Table 5 and the Breusch-Godfrey Serial Correlation LM
330   Test in Table 8. To address the problem of autocorrelation the study uses the Newey-West
331   standard errors that are robust to autocorrelation. There is however there is no evidence of the
332   presence of heteroscedasticity as presented in Tables 8.

333   Table 6 Normality test

334   **Conclusion and implications**

335   The results of the analysis confirm that the long term decline of gold jewellery
336   demand over the last twenty years has a statistically significant and adverse effect on gold
337   price volatility. The move away from gold jewellery by the current generation of Millennials
338   consumers in a range of countries will mean that the demand for gold will become
339   increasingly dependent upon investment demand and this, as has been shown will lead to an
340   increase in volatility of gold prices. The two most statistically significant factors in
341   explaining gold price volatility are global jewellery demand and investment demand. The
342   emphasis which gold industry stake-holders such as the World Gold Council and the mining
343   industry in general have traditionally placed on promoting gold jewellery consumption is
344   therefore entirely justifiable but increasingly difficult in light of the changing patterns of
345   luxury good consumption. Clearly an enhanced marketing strategy by key players lead by the
346   World Gold Council in the gold jewellery sector is now essential to avoid a worsening of
347   gold market instability.

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349   Tables
350   Table 1: Unit Root Test
351

Variable	Unit Roots Augmented Dickey-Fuller (ADF)			Degree of Integration
	Level	1st Difference	0.05 Critical Value	
JDD	-2.21	-11.34	-2.90	1
QE	-0.57	-4.48	-2.90	1
INV	-2.30	-9.59	-2.90	1
PSIL	-0.82	-6.90	-2.90	1
DJI	-0.82	-6.90	-2.90	1
CDD	-0.60	-8.94	-2.90	1

352
353   Table2: Gold Price Autoregressive Process

Coefficients	AR (4)	AR (3)	AR (2)
α_1	1.29 (10.81)**	1.29 (10.99)**	1.29 (10.64)**
α_2	-0.319(-1.63)*	-0.322 (-1.71)*	-0.30 (-2.73)**
α_3	0.00881 (0.041)	0.015 (0.13)	-
α_4	-0.005 (0.0045)	-	-
AIC	11.10	11.06	11.03

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355   Table 3: GARCH Estimates
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Coefficients	GARCH (1,0)	GARCH (1,1)	GARCH (1,2)	GARCH (2,1)
α_1	0.52 (0.03)**	0.24 (0.13)	-0.36 (0.13)	0.3 (0.21)
α_2	-	-	-	-0.11 (0.66)
β_1	-	0.82 (0.0000)**	0.084 (0.75)	0.0.86 (0000)**
β_2	-	-	0.65 (0.06)*	-
AIC	10.96	10.53	10.53	10.76

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358   Table4: GARCH Model Results for gold price volatility
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	Coefficient	Std Errors	Z-Statistics	Prob.
Constant (c)	12.97	36.15	0.36	0.7196
ARCH (α)	0.24	0.16	1.51	0.1318
GARCH (β)	0.83	0.12	7.1	0.0000**

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α + β	**1.02**
R^2	*0.985``````*
`tg bnm,	*1.94*

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362   Table 5: Long –run regression estimates

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Dependent variable: Gold price volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNJDD	-1.322198	0.527378	-2.507117	0.0153
LNQE	0.078099	0.331181	0.235821	0.8145
LNINV	0.766444	0.332546	2.304777	0.0252
LNPSIL	0.686479	0.263082	2.609369	0.0118
LNDJI	0.254708	0.677248	0.376092	0.7084
LNCDD	0.798522	0.443450	1.800702	0.0776
C	3.373015	6.063228	0.556307	0.5804
R-squared	0.931187	Durbin-Watson stat		0.739572
F-statistic	117.2784	Prob(F-statistic)		0.000000

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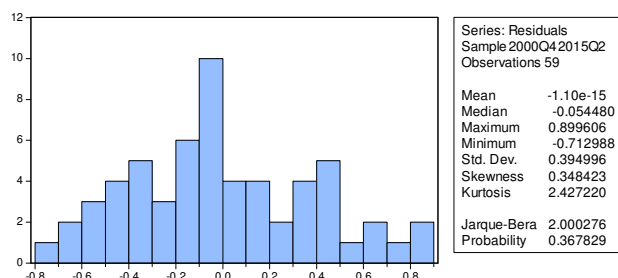366   Table 6 Normality test

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370   Table : Autocorrelation and Heteroskesdasticity Test

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Table 7: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	17.39546	Prob. F(2,50)	0.0000
Obs*R-squared	24.20854	Prob. Chi-Square(2)	0.0000

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Table 8: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.423104	Prob. F(6,52)	0.2236
Obs*R-squared	8.321612	Prob. Chi-Square(6)	0.2155
Scaled explained SS	4.612869	Prob. Chi-Square(6)	0.5943

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377   Figures
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379   Figure 1: Gold Composition Demand (1997-2016)
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383   Figure 2: Gold usage in the production of jewellery
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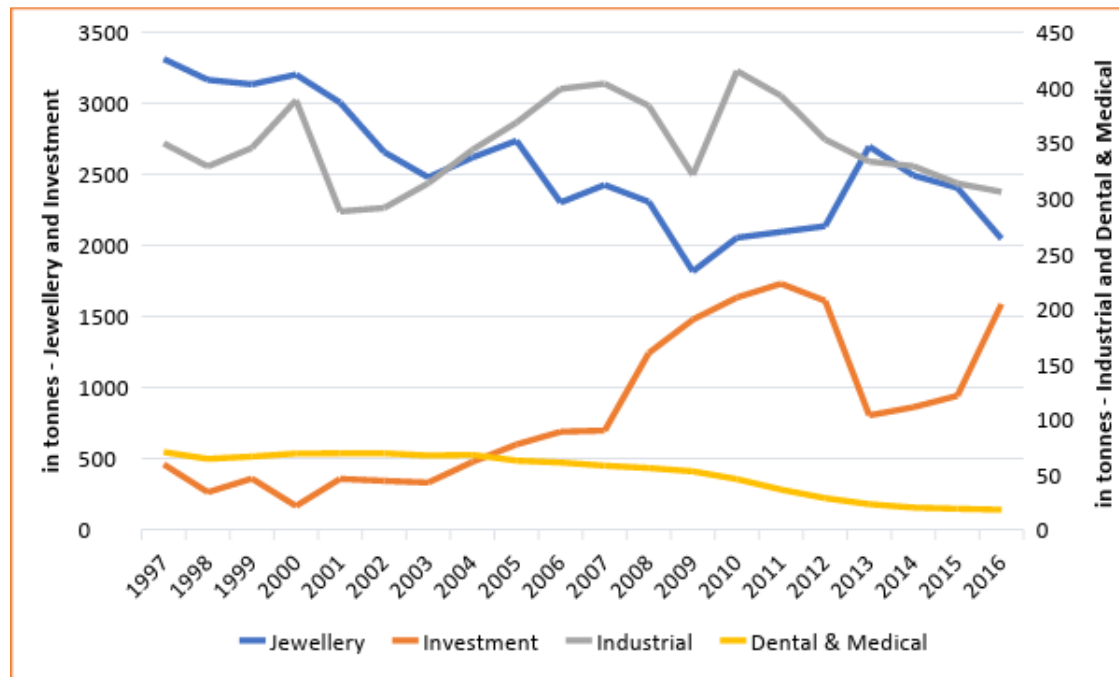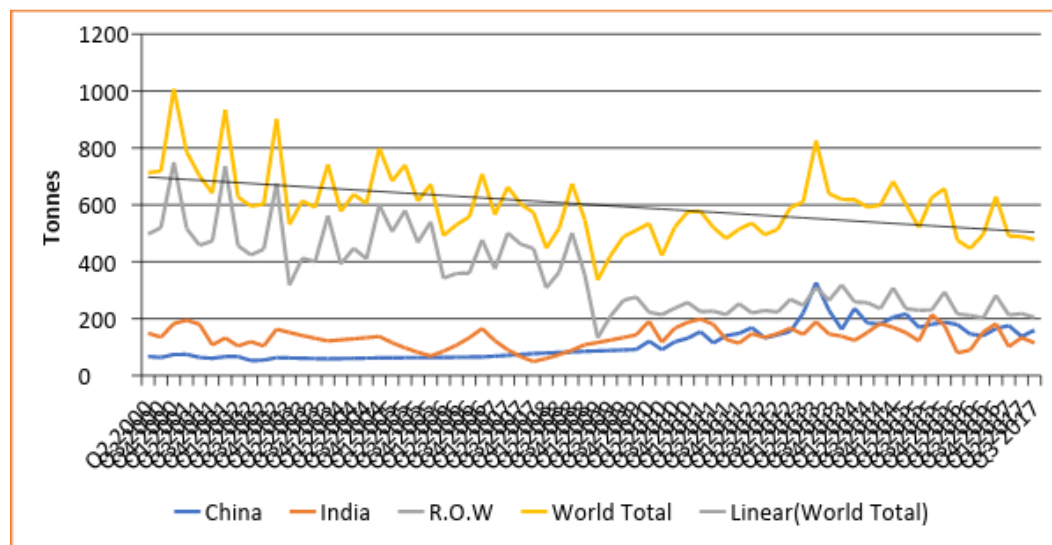393   Figure 3: **Intensity of Gold Use in Manufacturing (tonnes/ GDP)**

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