Market Analysis of the Proposed Change to the RFS Point of Obligation

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1 Introduction

This paper is intended to provide a summary review of the evidence documenting the Renewable Identification Number (RIN) pass-through, in addition to an analysis of the impact that would occur within the petroleum fuel market if the United States Environmental Protection Agency (EPA) does not change the point of obligation under the Renewable Fuel Standard (RFS).[1]

The paper opens with a short discussion concerning the expected level of RIN pass-through which economic theory under perfect markets would suggest, and follows with a description of the effect on pass-through if theoretically perfect markets break down.

Empirical evidence of RIN pass-through is presented in the following section, with sub-sections devoted to several different methodologies which have been used to analyze pass-through. The conclusion drawn in this study is supported by the weight of the empirical evidence; which suggests that there is limited pass-through under the current market structure.

The paper resolves with a market analysis that describes the economic impact of limited RIN pass-through, which includes a detailed discussion of refiners that may be at risk due to the distortionary cost of the RIN mandate. The discussion details the economic pathways in which limited RIN pass-through could lead to an increase in the refiners relative bankruptcy risk, as well as the impact on investment behavior, and potential job loss that may result if the current mandate remains unchanged. The conclusion of this discussion states that the overall economic hardship currently being imposed on refiners by the RIN mandate has placed a significant number of jobs—both directly and indirectly supported by the refiners—at risk. In addition, while the impact on regional economic output is more difficult to quantify, estimates suggest that the failure of a regionally important refiner would have a

[1]This study is intended for an audience that has a basic familiarity with the RFS program, and to some extent the RIN market. Should a primer on the particularities of the RFS be required, many other studies provide an overview of the program and the market—see for instance (Lade et al., 2015; Knittel et al., 2015; CRA, 2016b).

substantial adverse impact on the economic output of the region.

2 Review of Evidence Documenting RIN Pass-Through

2.1 Theoretical Expectations Under Perfect Markets

In a frictionless[2], and perfectly competitive market[3], the Point of Obligation for the RFS is theoretically irrelevant. The RIN simply acts as a tax, and a long literature in economics documents that the incidence of a tax—the entity on whom the tax is levied—is irrelevant to the market.[4] The cost of the RIN (and intrinsically, the biofuel being blended into the petroleum blendstock) is presumably fully passed through to the final consumer. It was this argument of theoretical irrelevance which was used to justify the EPAs original designation of refiners as the obligated party under the RFS (Agency, 2010).[5]

In the current market this would imply that the refiners (particularly the merchant refiners) are able to increase the price they charge for wholesale blendstock by exactly the marginal cost of the RIN. The blender meanwhile separates and sets the price of the RIN by selling it on the open market (either directly to refiners that are RIN short, or to intermediaries who eventually resell it to refiners), and pays the wholesale fuel price which incorporates the marginal cost of the RIN. The wholesale price is fully imposed on the consumer (along with some non-zero blender margin), who pays the retail price for blended fuel at the pump. Under the current standards the marginal cost of the RIN obligation is greater for fuels

[2] An assumption which implies that there are no frictions impeding economic activity (Either directly e.g. transactions costs, taxes, legal costs, regulatory costs; or indirectly e.g. barriers to market entry, information asymmetry, bankruptcy risk, etc.)

[3] This assumption implies that intense competition forces market participants to set prices at, or nearly at, marginal costs.

[4] Under the same assumptions—namely that the market is: frictionless, informationally efficient, and perfectly competitive.

[5] Because the EPA assumed that the point of obligation was theoretically irrelevant, they chose to place the obligations "[on] the relatively small number of refiners and importers rather than on the relatively large number of downstream blenders and terminals in order to minimize the number of regulated parties and keep the program simple." However, given the expanded mandates, and the expanding number of obligated parties, under RFS2 the EPA now acknowledges that "[the] rationale in RFS1 for placing the obligation on just the upstream refiners and importers is no longer valid."

which have less biofuel in the blend (e.g. E10) than it is for fuels with greater amounts of renewable fuel in the blend (e.g. E85). Which means that consumers pay relatively more for low biofuel blend fuels than higher biofuel blend fuels. Optimally, consumer demand is shifted towards higher biofuel blends which enjoy a "RIN subsidy", and away from lower biofuel blends which do not enjoy a similar subsidy.

In contrast—in such a perfect market— placing the point of obligation on the blender would remove non-integrated refiners from the RIN market altogether. Blenders would pay refiners the wholesale price of blendstock (now less the marginal cost of the RIN), and blend this with renewable feedstock for retail sale. All else equal, during the blending process, blenders will generate RINs in exactly the proportion at which they need to meet their Renewable Volume Obligation (RVO). However, given heterogeneous access to biofuel feedstock among blenders, it may be optimal for some blenders to generate more RINs than they require to meet their obligation because they have lower cost access to biofuel feedstock, and vice versa. Thus a RIN market would still exist, but only between blenders.[6] Blenders ultimately charge the retail price to consumers, who are unaffected as they still bear the full cost of the RIN (which given perfect markets, and thus full pass-through, is not theoretically different).

[6]Absent the restrictive assumptions of a perfect market, it is clear that some market mechanism for the exchange of RINs would still be necessary among blenders. The main reason being the nested structure of the RIN obligation. The RIN mandate requires obligated parties to supply a certain number of RINs from each of four biofuel categories (Cellulosic Biofuel, Biodiesel, Advanced Biodiesel, and Renewable Biofuel) whether or not they sell or generate retail fuel using each type of biofuel. The categories are nested such that a RIN separated from a biofuel that satisfies the stricter cellulosic biofuel category would also satisfy an obligated party's mandate in any of the less strict categories (see Lade et al. (2015) or Knittel et al. (2015) for a more detailed description of the RIN mandate and it's nested structure). Because blenders generally specialize in fuel types, any single blender is unlikely to generate RINs that satisfy all four categories. For example, a blender that primarily blends corn ethanol with RBOB will generate plenty of D6 RINs (possibly even a surplus), but is unlikely to also blend biodiesel and thus will be unlikely to generate enough D4 or D5 RINs to satisfy their portion of the RVO. Thus, some type of market exchange will exist so that obligated parties can source the RINs they need to meet their obligation.

2.2 Theoretical Expectations Under Imperfect Markets

However, market frictions, imperfect competition, asymmetric information, and other inefficiencies make the incidence of the point of obligation increasingly relevant; particularly when these types of inefficiencies affect the intermediate RIN market (CRA, 2016b). This forces refiners, who have the obligation to meet the RIN mandate, but have no control over how the fuel is blended, to purchase RINs through an imperfect market mechanism. Such a mechanism may distort the market so that the full price of the RIN is no longer passed on to the consumer, but rather is absorbed, in full or in part, by the refiner. In this manner the RIN "tax" becomes distortionary, rather than lump sum. What's more, if the RIN costs cannot be fully passed through then the RIN mandate ceases to resemble a tax at all[7] so much as a penalty; a pure wealth transfer between refiners and blenders. If the penalty becomes severe enough (i.e. RIN prices rise too high, and/or the proportion of the RIN cost refiners are able to pass-through diminishes) likely outcomes for refiners can include acute financial distress, and even bankruptcy.

On the other hand, there may still be little concern if the entirety of the RIN cost—which is now the sum of the marginal value of the RIN plus the proportionate costs that arise from market inefficiencies (increased transactions costs, illiquidity premiums, information asymmetry premiums, price squeeze risk)—could be passed onto the consumers through higher wholesale prices. Although even in this case it is important to note that even when an obligated party (such as a merchant refiner) with a net RIN obligation has that cost fully offset by charging higher prices for wholesale petroleum, they may still face RIN price pressure because of the difference in price between when the RIN obligation was incurred, and when they acquire the RIN to offset their obligation.[8]

It is unclear from a theoretical perspective which market outcome will result; thus the

[7] In the financial and accounting sense, at least.

[8] For instance, refiners may set the wholesale price by incorporating the expected future value of the offsetting RINs they will need. However, by the time they go onto the open market in order to purchase those RINs, so as to meet their obligation, prices may very well have gone up. Thus the refiner still bears the cost of RIN price pressure, even when they are technically able to pass the cost fully into wholesale prices.

investigation of RIN pass-through becomes an empirical one. There is still a robust debate in the empirical literature, however, recent evidence is strongly suggestive of less than perfect pass-through into wholesale or retail prices (CRA, 2016c, 2017a; Pouliot et al., 2017; Li and Stock, 2017b).

2.3 Empirical Results

Several methodologies for examining the level of pass-through have been used in the literature. Below I provide a short review of the most common methods: those that examine the level of pass through into wholesale fuel prices, those that examine the level of pass-through into retail fuel prices, and those that examine the level of pass-through by examining blender margins. The overall outcome of these studies holds great importance for the obligated parties because, "[If] RIN prices are not fully passed through to wholesale fuel prices, then an obligated party with a net RIN obligation is left with net RIN price exposure, so that an increase in RIN prices creates a financial burden on the obligated party that is not recouped by higher refined product prices" (Knittel et al., 2015).

2.3.1 Pass-through to Wholesale Prices

In a recent paper Knittel et al. (2015) (Hereafter, KMS) examine the pass-through of RIN prices into the wholesale and retail fuel cost. The study examines 6 different fuel price spreads (3 diesel and 3 gasoline, both domestic and international)[9] , and the level of both short term, and long run, pass-through. The authors present evidence showing that the majority of the RIN price (97%) is passed through quickly, but not immediately, to wholesale prices for obligated fuels; while finding almost no evidence of pass-through to prices for E85. The main results in KMS are estimated from a model specification in which both gasoline and diesel spreads are pooled together. However, in a specification in which the pass-through on

[9]The spreads of interest are : Gulf Diesel—Gulf Jet Fuel Spread; NYH Diesel—Rotterdam Diesel Spread; Gulf Diesel—Rotterdam Diesel Spread; NYH RBOB Futures—EBOB Spread; NYH RBOB Futures—Brent Spread; and LA RBOB—Brent Spread.

the two fuel types was estimated separately, they observe significantly different rates—78% for gasoline and 120% for diesel—results which suggest that the modeling assumptions made by KMS may not be justified. The estimates of pass-through when the two fuel types are separated give rise to several important implications. First, given that the vast majority of fuel, produced and sold, is gasoline, an estimate of only 78% pass-through equates to a significant penalty on RIN short refiners. Second, over pass-through on diesel prices has little economic justification; which suggests either incorrect specification of the model, or that the market dynamics for diesel fuel allow for significant pricing power at the retail level.[10]

More evidence has recently come to light, which suggests that the results presented in KMS may simply be an artifact of their sample period.[11] In a recent report prepared by Charles River Associates (CRA) the authors replicate the KMS study, but include an additional 14 months into the estimation period (CRA, 2016c). They duplicate the KMS result of pass-through during the initial KMS sample period, but find significantly different results when the model is estimated across the entire sample period. In fact, CRA (2016c), show little, or no, evidence of long-run pass-through for two of the three gasoline spreads, and a significant decrease in the long-run pass-through for diesel. The short term pass-through is not statistically different from zero for five of the spreads and is approximately 60% for the sixth spread (Gulf Diesel—Rotterdam Diesel Spread). The CRA results suggest that the additional 14 month period is quite different from the original sample period, and that both spread levels and pass-through estimates are statistically different between the two periods.

In response to the issues raised above, KMS offer an addendum to their original work in Knittel et al. (2016). To address any concern about time period dependent results they extend their sample period by several years. However, in order to obtain the same result, they were forced to simultaneously drop two of the six original spreads from their sample,

[10] In fact, Benavides (2017) suggests that the market dynamics for diesel may be significantly affected by the presence of large retailers that specialize in diesel fuel sales. These large retailers retain significant pricing power over their smaller counterparts, and enjoy increased margins in relation. It may be that their pricing control is extensive enough to allow them to impose a pass-through on diesel fuel of greater than one.

[11] Knittel et al. (2015) examine daily RIN prices from January 2013 - to March 2015.

and create a new spread which is highly correlated with one of the remaining four (CRA, 2017b).[12] In addition they continue to pool the gasoline and diesel spreads during estimation, despite evidence from their own results which suggest that the pooling approach is not valid.[13] Knittel et al. (2016) once again implies substantial pass-through of RIN prices into fuel prices (91%). However, given the significant changes to the sample (they extend the sample period, but change three of the spreads, and continue to pool gasoline and diesel) it remains to be seen whether they continue to document almost full pass-through because of these changes, or in spite of them.

2.3.2 Pass-through to Retail Prices

Li and Stock (2017b) investigates the level of pass-through, to retail prices of E10 and E85, for the state of Minnesota, using station-level monthly prices for blended fuel from 2007-2015. They examine several assumptions about retail/blender behavior[14], and show that RIN pass-through varies between 30% and 80% on average across the state.[15] Lade and Bushnell (2016) also examine RIN pass-through into retail prices at the station level (for E85 only), but on a slightly larger geographic sample that includes Iowa, Illinois, and Minnesota. The study finds evidence of more substantive pass-through on E85 than what has been shown previously in the literature, albeit only after a substantial time lag—84%

[12]The new spread (NYH CBOB spot—EBOB) is highly correlated with the NYH RBOB Futures—EBOB Spread. Which has one of the highest estimated pass-through levels. Adding a new spread that is highly correlated with one that is already in the sample, adds additional data points that will also suggest high levels of pass-through. This change is particularly troubling, because they simultaneously drop two of the original spreads, both of which had a great deal of variation, and did not exhibit strong evidence of pass-through.

[13]The assumption underlying this approach *requires* that gasoline and diesel have identical pass-through rates. However, CRA (2017b) explicitly test this assumption and find that—at least during some time periods—the assumption of equal pass-through does not hold.

[14]For example : That retailers purchase blended fuel at the rack; that they splash blend; or that they take a position above the rack. In the latter two cases the paper examines whether the RIN price is passed into the retail price for gasoline.

[15]They also document competitive effects—retailers with more competition in the area pass-through more of the price of the RIN. In addition they show that retailers who are affiliates of RFS obligated parties, while still having a less than 100% pass-through rate, have a lower variance of pass-through rates. Which may indicate that integrated refiners pay a significantly lower, and more consistent, effective RIN price than merchant refiners, because integrated refiners generate the RINs they require, rather than being forced to purchase them on the open market.

after 6 weeks, and 94% after 8 weeks. However, their results seem to be largely a function of several distinct modeling choices. For one, despite using a very similar econometric approach to KMS they arrive at distinctly different results; in large part it appears, because of their choice to allow for such a long absorption rate (6-8 weeks).[16] This is potentially problematic because a core identifying assumption in the model is that the fluctuation in RIN obligations is locally exogenous in time (CRA, 2016a). However, with lags of such length the potential for confounding events that affect RIN prices, within the time frame, increases, which may lead to incorrect estimation of the model. Several other issues raised by CRA (2016a) suggest caution when interpreting, or attempting to generalize these results.

2.3.3 Pass-through to Blender Margins

Additional evidence documenting less than full pass-through is presented in a second report by CRA (2017a), which investigates the correlation of blender profit margins' with RIN prices. The authors of this report show that at least in three major U.S. fuel markets (New York, Chicago, and Houston) blenders are capturing a significant percentage of the RIN value as profit; in other words, blender margins are positively correlated with RIN prices.[17] The results suggest that blenders in the branded market capture anywhere from 44-63% of the RIN value, and blenders in the unbranded market capture up to 56% of the RIN value. Recent work by Pouliot et al. (2017) significantly extends the scope of the analysis of blender margins to many other markets and geographical segments within the United States.[18] They find qualitatively similar results for their sample, albeit with quite

[16] In other words, they allow for the RIN to pass-through into retail prices over a much longer time period.

[17] The expectation, under the perfect market scenario drawn in Section 2.1 would be that there is zero correlation between blender margins and RIN prices. After all, RIN prices should be incorporated back into the wholesale price charged to blenders, whose margin is simply the difference between the wholesale price and the retail price. If blender margins increase when RIN prices increase, it implies that refiners are unable to charge a wholesale price that fully incorporates the RIN price, and thus that blenders are capturing a fraction of the RIN price as profit.

[18] Specifically they examine margins at the rack in: 10 large cities across the U.S., cities in the U.S. that sell E85 extensively, and all of Iowa, Illinios, and Minnesota.

a bit of heterogeneity across regions.[19] The paper documents RIN pass through of 47-79%, and 43-78%, for branded, and unbranded, E10, respectively; with similar, but much more variable, results for E85. Average pass-through across all cities and fuels is reported to be 63% for branded fuel, and 92% for unbranded fuel—results which suggest that "[the] RIN value is not being fully passed through to consumers" (Pouliot et al., 2017).

2.3.4 Overall Takeaway from the Empirical Literature

All three strands of the literature examine the relationship between RIN prices and the level of pass through into fuel prices. Taken as a whole, the results seem to be strongly suggestive of less than perfect pass-through, with a significant amount of time-series and geographical variation in the estimated level of pass-through.

The evidence from Section 2.3.1 is mixed. Two papers by KMS both estimate that the pass-through to wholesale fuel prices is high (implying that the RIN price is largely passed to consumers, and that there is limited burden on refiners). However, work by CRA calls into question both the results of the KMS papers, and their underlying methodology. CRA shows that modeling assumptions like pooling gasoline and diesel spreads may be econometrically flawed, by presenting evidence that the two fuel types exhibit statistically different behavior during the sample period. They also find that even when assuming that KMS made perfect modeling choices, their results are sensitive to the time period over which the model is estimated. These issues, among several others, should act as a counterweight to the importance placed on the KMS findings—at least until additional work leads to more robust results.

The evidence from Section 2.3.2 is also mixed. Li and Stock (2017b) find significant evidence of less than complete pass-through into retail prices in Minnesota, while Lade and Bushnell (2016) present evidence of much closer to complete pass-through in Minnesota, Iowa, and Illinois. Meanwhile CRA once again calls into question many of the modeling

[19] For instance, there appears to be substantially less pass through in the Eastern U.S. (38-50%) than in the Gulf (88-89%) or Midwest (86-99%) regions.

assumptions used by Lade and Bushnell (2016) in their analysis.

Finally the evidence from Section 2.3.3 is predominantly in support of a hypothesis of less than perfect pass-through. Blender (and retailer) margins show significant evidence of a positive correlation—across a great variety of domestic markets— with RIN price movements, indicating that blenders/retailers capture a significant portion of the RIN value as profit.

3 Economic Impact of Sub-Optimal Pass-Through

If the tax imposed on refiners by the current structure of the RIN market is, in actuality, passed through fully to consumers—which will only be the case in a perfectly competitive and informationally efficient market—then this tax would only be lump-sum rather than distortionary.

However, given the significant evidence that the RIN market is neither perfectly competitive nor informationally efficient, it follows that the RIN tax is having a largely distortionary effect on refiners, and merchant refiners in particular. The impact of such a distortionary tax on the market structure, and the economic welfare of the market participants, is discussed below.

3.1 Distortionary Taxes, Subsidies, and Wealth Transfers

"A variety of tax-favored entities compete with [tax-disadvantaged] firms in a broad range of industries." Rose-Ackerman (1982). Direct competition between tax-favored and tax-disadvantaged entities causes a distortion in a market because the lack of a tax is equivalent to a subsidy. The firms who must pay the tax will, other things equal, have a higher break-even level, which puts them at a competitive disadvantage. This disadvantage will be particularly severe when the "tax status" of the firms in the market is exogenously imposed.[20]

[20]Exogenously imposed because the stakeholders of the merchant refiners—the firms' investors and employees— entered into the market without any chance to anticipate that such a penalty would be levied upon them, while simultaneously providing a subsidy for their integrated, or down stream, competitors.

In this setting the RIN obligation essentially acts as a government mandated wealth transfer between those obligated parties which are functionally RIN short (the merchant refiners) and those parties which are naturally RIN long[21] (blenders and integrated refiners).[22]

This occurs because the demand for RINs is imposed exogenously by the RFS, but the creation of, and thus the supply of, RINs is an endogenous decision by the blenders—only some of which have obligated demand. This effectively divorces supply from demand. The RVO mandated by the RFS continues to grow, which in turn forces the demand for RINs to grow as well (absent any real market demand pressure). However, there is no equivalent exogenous pressure on the supply of RINs; because blenders are not the obligated party they can choose to generate RINs to satisfy actual market demand for biofuel blends - which may or may not be enough to meet the mandated demand of RINs for refiners.[23]

This gives rise to a competitive disadvantage borne by merchant refiners because they face the potential of a significant price squeeze. The integrated refiners can meet their obligation internally, and internally pass the true marginal cost of the RIN into the retail price and consumers. In addition, they also have the potential to generate a RIN surplus over their obligated need. However, neither integrated refiners or independent blenders have an obligation to generate a surplus, even if the mandated RVO necessitates such a surplus.[24] Meanwhile, merchant refiners *must* purchase RINs in the open market to meet their obligation, and in doing so must pay the open market price for their RINs. Where once again they face a distinct disadvantage because of the inherent inefficiencies of an over-the-counter (OTC) trading market (CRA, 2016b).[25]

[21]The two largest of which are large foreign based multi-national integrated refiners: British Petroleum (BP) and Royal Dutch Shell.

[22]Which is not to say that a sort of wealth transfer was not the intended outcome of the RFS; there was certainly an intention to subsidize biofuel production via the introduction of the RIN market. However, the presence of the, very large, integrated refiners and retailers distorts the intention of the RFS (subsidize biofuel producers) so that they are also being subsidized via the RIN market.

[23]Which is what gave rise to the market uncertainty surrounding the approach of the E10 blend-wall.

[24]In addition, even if a surplus is generated, there is significant information asymmetry between obligated parties about RIN availability and distribution. Which means that there are potentially significant search costs for obligated parties that are RIN short as they seek to meet their obligation.

[25]Which include but are not limited to: information asymmetry between traders; lack of information about: true RIN value, market depth, RIN positions, and recent trades; and significant uncertainty over the

If, as the evidence presented in Section 2.3 suggests, merchant refiners are forced to pay a price for RINs in the open market that exceeds their fundamental value, then they may be unable to pass that on to blenders by raising the wholesale price for blendstock. There are three potential reasons for this. The first is because "merchant blenders" still have to compete with the integrated refiners at the retail level, and the integrated refiners paid an effective price for the RIN that was less than the market price (they paid the true marginal value). Which means that blenders must pay refiners the same effective wholesale price in order to compete at the retail price level. The second is because merchant refiners also compete with integrated refiners at the wholesale level, where integrated refiners can, by the same logic, compete with them on wholesale prices offered to blenders.[26] The third is that independent blenders also have to compete with large retail chains that have moved their supply source above the rack in order to blend their own fuel. Because these retail chains are also not obligated parties under the RFS, they have are able to capture additional profit from selling the RINs generated during blending. This puts substantial pressure on smaller independent retailers who lack the necessary capital to follow the same approach. These retailers now face RIN subsidized competitors, and in order to remain competitive they must try to source competitively priced fuel—price pressure which will be forced up the supply chain should their bid succeed.[27]

It stands to reason that this argument provides a possible explanation for the dramatic switch from relatively low RIN prices and relatively complete pass-through, to relatively high RIN prices (and high price volatility) and significantly lower pass-through. Once the blendwall was reached, and supply and demand were forced apart, blenders, integrated refiners, and large retailers, gained significant pricing power over the RIN market.

actual EPA mandate in a given year(CRA, 2016b).

[26]The integrated parties can compete at several levels: they can sell surplus unblended fuel at the wholesale level to independent blenders, sell blended fuel through their own retail chain, or sell blended fuel to independent retailers.

[27]However, the evidence suggests that the smaller independent retailers are unable to produce any price pressure upstream, and they are now facing significant financial uncertainty (Weinstein, 2016; Douglass, 2016a). Many have joined the calls for the point of obligation to be shifted, so as to restore the competitive structure that used to exist in the retail market (Douglass, 2016b).

3.2 Impact on Firm Decision Making

Tax policy in the U.S. has played a significant role in the investment decisions of U.S. based firms. Auerbach and Hasset (1992) document that changes in a firms' expected tax burden can have a destabilizing effect on investment. As such, to the extent that RINs act as a distortionary tax on the returns from firm investments, the firms' investment strategy will be distorted. This distortion can affect a firms investment choice set in several different ways: it can affect the firms investment in fixed capital, so that they avoid making investments in new fixed assets; and it can also affect a firms investment in growth opportunities, especially as increased operating costs (due to the RIN mandate) reduce the set of potential growth options.[28] To avoid this wealth transfer, refiners may be incentivized to move future investment capacity outside of the domestic market to one in which they will not face the tax (Boskin and Gale, 1987). However, the refinery business is very capital intensive, and transferring investment capital overseas may be out of reach for all but the largest refiners. Thus, as the burden of the costs associated with the RIN mandate slowly reduces the investment choice set available to refiners (especially small merchant refiners), bankruptcy may become an increasingly likely outcome.

3.3 Impact on Bankruptcy Risk

The pathway that leads from the financial burden imposed by the RIN mandate towards distress and bankruptcy in the refinery sector is fairly straightforward. Because, despite the fact that economically speaking we can treat the cost of the RIN obligation as a distortionary tax, *it is not* a true tax in the financial or accounting sense. There is very much a danger when economists refer to an economic burden as being "similar to a tax" without explicitly quantifying the financial differences between a true tax and the burden in question. The danger is that, in this case, there are no offsetting benefits to the RIN cost, like there would

[28] Both of these outcomes are likely to have a deleterious effect on an already shrinking, and aging, refining infrastructure in the United States.

be for a governmentally imposed tax on earnings. A true tax, like the corporate income tax, cannot force a firm into financial distress. In general, this is because firms cannot have a tax liability that causes them to incur negative earnings; in fact, at the extreme, when firms incur a loss they receive an effective tax credit through a tax loss carry forward.

There are no equivalent accommodations for the RIN obligation. The cost of the RIN obligation for refiners is treated in an accounting sense just like any other operating cost—because of course, *it is* an operating cost. This means that when refiners are unable to pass the financial cost of the RIN obligation into the wholesale fuel price, refiners' margins and earnings will be reduced. If the distortionary burden of the RIN obligation becomes large enough, refiners may very well begin to experience acute financial distress and eventually, if nothing changes, be forced into bankruptcy.

4 The Economic Ramifications of Not Changing the RFS Point of Obligation

In the section below I will discuss in general the refiners which would be expected to face the greatest financial risk given the current point of obligation, the components and causes of that risk, the potential outcomes—including bankruptcy, and the impact of those outcomes on the stakeholders of the firm and the surrounding economic region.

4.1 At-Risk Refiners

If you categorize refiners according to the degree of financial risk they face, all else equal, it is likely to be the East Coast and Mid-con refiners that face the most risk. The main sources of risk to the East Coast refiners stem from their higher operating costs, significant logistical challenges in sourcing crude oil, and direct competition from large foreign based refiners in the Atlantic basin and the European Coast. The Mid-con refiners likewise, face

large logistical challenges in production and supply, while also being generally smaller[29], and because they are landlocked they have much less opportunity to avoid the RIN cost via exporting fuel[30].

4.1.1 Financial Risk

The bankruptcy of any refiner is certain to have a large financial impact on the stakeholders of the refiner (employees and investors), all the other businesses which have dealings with the refiner, and via both these channels on the economic region in which the refiner does business.

In particular, failure of any of the East Coast refiners could give rise to a significant supply shock in the East Coast fuel market, given that the domestic supply to the East Coast is already relatively constrained. The Colonial pipeline system is the main artery that transports fuel from the Gulf refiners to the East Coast, and it is already operating at capacity. If one, or more, of the East Coast refiners were to cease production it will likely result in a shortage of fuel along the East Coast, because there is no additional pipeline capacity available to allow for an increase in supply.[31] Consumers in the region are likely to experience a significant increase in the price of fuel[32], before the supply shortage is filled by foreign refiners—either along the European coast or within the Atlantic basin. Similar shocks to the Central U.S. market are likely to occur if a major refiner filed for bankruptcy in the Mid-con market. Temporary closures of major refineries in the Midwest have resulted in price hikes in Chicago and throughout Illinois, which were severe enough to cause the Mayor and State Attorney General to involve themselves in the local petroleum market (Milne, 2010; Popely, 2015; Cancino, 2015).

[29] Which, all else equal, is often an indicator of financial constraint, and limited capital mobility (Hadlock and Pierce, 2010).

[30] Exported fuel does not fall under the RIN mandate.

[31] This problem is further exacerbated by the Jones Act, which restricts the Gulf refiners ability to shift fuel to the East Coast via other methods than the colonial pipeline (e.g. by tanker).

[32] Evidence of this already appeared during several recent failures along the Colonial pipeline, which halted transportation of fuel to the East Coast. Consumers experienced a rise in prices all along the Eastern Seaboard and the Southeastern United States (Mufson, 2016; Klepal, 2016).

Compounding the rise of the price at the pump, will be the resulting loss of employment for the area, as well as the indirect loss of business for the many local entities that supply, maintain, or otherwise interact with the refinery. Estimates of economic impact are often limited in potential scope, because of the difficulty involved in accurately predicting the entirety of the future impact of a closure.[33] This type of analysis should be used mostly as an indication of the economic severity of a potential closure, or within a worst-case scenario type analysis. To that end, an analysis released in anticipation of the closure of two refineries in Pennsylvania (the ConocoPhillips-Trainer and Sunoco-Marcus Hook refineries in Delaware County—hereafter CPT and SMH refineries) estimated that the loss of every 100 refinery jobs could reduce the output of the local economy by as much as 1 billion dollars (CFWIA, 2012).[34] While this figure may be overstated (it is likely to be on the high end of the worst case scenario) it is evidence that the loss of a refinery, and the jobs associated with it, would have a substantial negative economic impact on the surrounding region.

4.1.2 Labor Risk

A distortionary tax can affect the labor supply by reducing the after-tax wage for labor, which will then reduce the supply of labor. However, if the labor supply, or wage, is fixed the tax may instead act to distort profits, thereby causing a financial burden on firms (Bovenberg and A de Mooij, 1994). If the distortion becomes severe enough to cause financial distress, or potentially leads to bankruptcy, it is the labor of the firm that will suffer most acutely. This is due to labor capital being relatively less mobile than financial capital.[35] The employees of the firm, and particularly those classes of labor which are least able to gain comparable re-employment, will bear the brunt of any refinery closure or bankruptcy.

[33]For instance, business lost by a supplier or contractor may be made up in a different area, or through a new contract with a different entity. However, these kinds of dynamic market shifts are difficult to predict under the best circumstances, so estimates should always be interpreted cautiously.

[34]This figure includes loss of output from sales in the region (including refinery sales, and sales to and from related entities that would be lost), labor income from refinery employees and associated entities, and lost tax revenue from all sources.

[35]In other words, it is much easier for the firms investors (financial capital) to diversify, and hedge, away the risk of financial distress, than it is for the firms employees (labor capital).

Estimates of the total jobs lost as a result of a refinery closure vary substantially (CFWIA, 2012), but we can say with certainty that those employees whom are directly employed by the refinery will be out of work—at least temporarily. While the job loss will be an acute negative outcome for the individuals[36], it is the length of unemployment for displaced workers that will be the most significant impact factor for the local economy. If the employees are quickly able to find re-employment the economic impact on the region could be minimal, but if their unemployment is long term the impact will be more severe. In their analysis of the potential closures of the CPT and SMH refineries, CFWIA (2012) estimates that 39% of the CPT labor force (156 workers) would face a fair to difficult time finding re-employment, while 42% of the SMH labor force (250 workers) would face a fair to difficult time.[37] With an estimated 10-18 indirect jobs lost for every direct refinery employee laid off during bankruptcy, the total jobs lost in the Southeastern Pennsylvania region could have approached 15,000-20,000 workers.

An extrapolation of the CFWIA (2012) analysis to estimate the impact of closures across the whole set of potentially at risk refiners[38] indicates that the estimated total potential jobs at risk is substantial. Just twelve of these refiners directly employ approximately 7,500 people, and anywhere from 2,000-10,000 daily contract workers. Loss of work for every direct employee[39], and the multiplier (10-18x) would suggest that 75,000 to 150,000 jobs are potentially at risk. A great many of these jobs will likely be unionized labor, as the majority of these refineries are either entirely unionized or have large union labor bases. Considerably more jobs are at risk if we consider a more limited multiplier effect for daily contract laborers

[36]Something that should not be overlooked in the analysis of these potential outcomes.

[37]The employees that would have a more difficult time finding re-employment are those whom hold positions that are more specific to the refinery industry, and thus would find difficulty doing the same job with a different entity. Examples listed in the CFWIA (2012) report include: Crushing, Grinding, and Polishing Machine Operators; Petroleum Pump System and Refinery Operators; Separating, Filtering, Precipitating and Still Machine Operators; and Tank Car, Truck and Ship loaders; among others. The type of high pay, but labor intensive, jobs which are particularly difficult for a local economy to replace.

[38]East Coast: Trainer, PES Philadelphia, PBF Paulsboro, PBF Delaware City; Mid-Con: HollyFrontier Tulsa, HollyFrontier Navajo, CVR Wynnewood, CVR Coffeeville, P66 Ponca City, VLO Ardmore, Delek El Dorado, Western Refining Gallup NM, Alon Krotz Springs, Wyoming Newcastle; among others.

[39]This outcome would only present, in the unlikely event that every at risk refiner filed for bankruptcy. However, it does represent a true worst case scenario for the market.

who also lose their employment—many of whom are also union members. If an average of 40% of those jobs lost will face a fair to difficult time finding re-employment, the economic cost to the regions in which these refineries operate will be extensive.[40]

5 Conclusion

In this study I gather and present extensive evidence documenting the economic harm caused to petroleum refiners in the U.S. by the current structure of the RFS. I argue that if the EPA does not choose to relocate the point of obligation, the burden of the RIN mandate may very well force those refiners already in precarious financial positions into acute financial distress, and possibly even bankruptcy. As is usually the case in bankruptcy, it is the employees of the firm who will suffer the most acute economic hardship, especially if they are unable to quickly find comparable re-employment. In addition, estimates suggest that the ripple effect of a large bankruptcy will also have a substantial negative impact on the economic output of the surrounding region, beyond what occurs due to the direct jobs lost in any closure.

[40] Particularly, given that many of these refineries are located in small towns, and act as one of the main (if not the only) economic engines for their region.

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